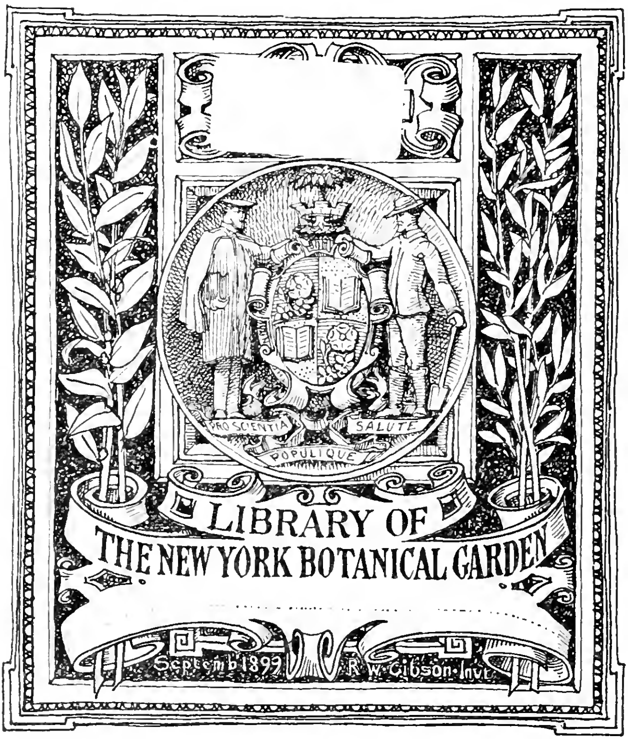

PRO SCIENTIA
SALUTE
POPULIQUE
LIBRARY OF
THE NEW YORK BOTANICAL GARDEN
Septemb 1899
R. W. Gibson Invt

TWENTY-SEVENTH ANNUAL REPORT

OF THE

SECRETARY

OF THE

MASSACHUSETTS BOARD OF AGRICULTURE:

WITH RETURNS OF

THE FINANCES OF THE AGRICULTURAL SOCIETIES,

FOR

1879.

LIBRARY
NEW YORK
BOTANICAL
GARDEN

BOSTON:
Rand, Avery, & Co., Printers to the Commonwealth,
117 Franklin Street.
1880.

LIBRARY
NEW YORK
BOTANICAL
GARDEN.

STATE BOARD OF AGRICULTURE, 1880.

Members Ex-Officiis.

His Excellency JOHN D. LONG.
His Honor BYRON WESTON.
Hon. HENRY B. PEIRCE, *Secretary of the Commonwealth.*
CHARLES A. GOESSMANN, *State Agricultural Chemist.*
CHARLES L. FLINT, *President Massachusetts Agricultural College.*

Appointed by the Governor and Council.

	Term Expires.
JAMES S. GRINNELL of Greenfield	1881
JAMES R. NICHOLS of Haverhill	1882
MARSHALL P. WILDER of Boston	1883

Chosen by the County Societies.

Massachusetts	E. F. BOWDITCH of Framingham	1882
Essex	BENJAMIN P. WARE of Marblehead	1881
Middlesex	JOHN B. MOORE of Concord	1882
Middlesex North	A. C. VARNUM of Lowell	1883
Middlesex South	THOMAS J. DAMON of Wayland	1881
Worcester	O. B. HADWEN of Worcester	1881
Worcester West	WILLIAM A. WARNER of Hardwick	1881
Worcester North	JOHN F. BROWN of Lunenburg	1881
Worcester North-West	J. P. LYNDE of Athol	1883
Worcester South	SAMUEL N. GLEASON of Warren	1883
Worcester South-East	VELOROUS TAFT of West Upton	1882
Hampshire, Franklin, & Hampden,	J. H. DEMOND of Northampton	1882
Hampshire	FLAVEL GAYLORD of Amherst	1883
Highland	ABIEL K. ABBOTT of Chester	1881
Hampden	WILLIAM R. SESSIONS of Hampden	1882
Hampden East	HORACE P. WAKEFIELD of Leicester	1882
Union	HENRY K. HERRICK of Blandford	1883
Franklin	JOHN S. ANDERSON of Shelburne	1883
Deerfield Valley	OTIS J. DAVENPORT of Coleraine	1881
Berkshire	HENRY M. PIERSON of Pittsfield	1882
Hoosac Valley	A. W. PRESTON of North Adams	1882
Housatonic	MERRITT I. WHEELER of Great Barrington,	1882
Bristol	AVERY P. SLADE of Somerset	1881
Plymouth	JOHN LANE of East Bridgewater	1881
Hingham	EDMUND HERSEY of Hingham	1882
Marshfield	GEORGE M. BAKER of Marshfield	1882
Barnstable	AUGUSTUS T. PERKINS of Cotuit	1883
Nantucket	ALEXANDER MACY, Jun., of Nantucket	1882
Martha's Vineyard	DAVID MAYHEW of North Tisbury	1883

Charles L. Flint, *Secretary.*

THE

TWENTY-SEVENTH ANNUAL REPORT

OF THE

SECRETARY

OF THE

BOARD OF AGRICULTURE.

To the Senate and House of Representatives of the Commonwealth of Massachusetts.

AT its last annual meeting, the State Board directed that the several agricultural societies receiving the bounty of the State should hold at least three Farmers' Institutes within their limits in the course of the year, promising, at the same time, to furnish them all the aid in its power to render such institutes interesting, attractive, and instructive to the public. In accordance with this requirement, with which the societies very cordially complied, more than a hundred meetings for lectures and discussions have been held in all parts of the State, and they have been generally well attended, and productive of much good.

This movement really constitutes a new departure in the management of many of the agricultural societies. The Board had repeatedly, in former years, requested the societies to initiate this method of operation; and some of them had adopted the suggestion, and found it so popular, and productive of so much interest, that they had continued to hold such meetings in various portions of their territory, though not absolutely required to do so till the past year.

These frequent meetings have created an unusual spirit of inquiry, and led to many interesting and valuable experi-

ments. As a result partly of the interest awakened by this means, the area devoted to the culture of Indian corn has continued to increase, while more than usual attention has been given to the culture of the sugar-beet with reference to the manufacture of sugar; and this promises to open up a new industry, which may hereafter grow up to some degree of importance. It is understood that machinery has already been ordered for one or two factories, which will at least test the practicability of doing something in that direction to supply the demand for an article of prime necessity in every household. Some valuable investigations upon this crop will be found on a subsequent page of this Report.

The dairy may be said to constitute the leading interest of this State. According to the last census, that of 1875, while some of the old staple crops show a falling-off, the products of the dairy show a decided, and in many sections a very large gain. This has been the tendency for some years past, and it will probably continue to be so in the future. It is not surprising, therefore, that great ingenuity has been exerted to improve the methods of handling milk, and to devise new contrivances for the raising of cream and the manufacture of butter. Very considerable space has been devoted to this subject in the following pages, to which reference is respectfully made. The Board has held its regular public meetings as usual, and they were more largely attended than ever before. An exhibition of butter and cheese was held in connection with the meeting at Greenfield; and several hundred dollars were offered and distributed in premiums, the awards being made by a committee of experts.

The public meeting for lectures, essays, and discussions, seems to be the most direct and efficient way of reaching a large body of farmers. A social gathering where all meet on the same footing, where questions are always in order, and where many experienced farmers who may be regarded as experts in various branches of farming are ready to impart their knowledge, and the results of their experience, offers many advantages which no exhibition, however well conducted, can possess.

PUBLIC MEETING OF THE BOARD

AT GREENFIELD.

The country meeting of the Board for 1879 was held at the town-hall in Greenfield, on the 2d, 3d, and 4th of December. James S. Grinnell, Esq., a member of the Board, and Chairman of the Committee of Arrangements, called the meeting to order at twelve o'clock on Tuesday, Dec. 2, and read the opening address, as follows: —

Gentlemen of the Massachusetts Board of Agriculture, — As chairman of the committee of arrangements for this meeting of the Board, it is my duty to call this assemblage to order, and as the president of the Franklin-county Agricultural Society, at whose invitation you have honored us, it gives me much pleasure to welcome you to the county of Franklin, and to this its county-seat.

Fourteen years ago this month, this Board held the second of these "country meetings" here, at which the lamented Agassiz, instructive and earnest in every thing he essayed, was the leading character, assisted by others of less distinction, some of whom have gone from among us, while others are here to aid and instruct us to-day.

That meeting, well remembered, left germs of thought which rooted, and bore fruit; and the names, the persons, and the words, of those who represented you at that meeting, have not been forgotten in this valley, nor on the farthest hillsides that encompass us about.

It has become customary on these occasions, in the opening address to give a brief sketch of that portion of the State, and of its progressive agriculture, and of the society, where you are invited; a chief element of good in these gatherings being, not only to disseminate in one part of the Commonwealth the opinions and results of the experience of farmers from other localities, but also to give to those who attend from abroad a more thorough acquaintance with the country and people where they visit.

The county of Franklin was set off from the old county of Hampshire, and organized as such, by an act of the Gen-

eral Court approved June 24, 1811, containing twenty-four towns lying on both sides of the Connecticut River, which were subsequently increased to twenty-six by changes of boundaries within the county limits. The first settlement in the western part of this State was made in 1636, on the fertile meadows of the beautiful Connecticut, and called Springfield.

This gradually grew, especially northward, up the rich alluvion of the river, till in 1662 so much of a population had gathered in this part of the State as to warrant the organization of a county called Hampshire, from the English home of the first settlers, with very indefinite limits east and west, but north and south fixed soon after by the boundaries of Vermont and Connecticut.

Subsequently town lines were established, dividing it from Worcester on the east, and setting off Berkshire on the west.

This county of Hampshire covered the largest and richest extent of territory in the province of Massachusetts Bay, but was not rapidly settled. Spiritual quarrels and doctrinal discussions among the people somewhat retarded their advance. It was a long journey — with no road through the shaggy wilderness — from the little communities by the seashore, where they had then but scant possession; and the settlers here, as elsewhere, met the most determined resistance from the original occupiers of the soil in their constantly advancing encroachments. And why not? Was not this a country to love and to fight for? These warm meadows and sunny slopes were favored places where to grow their corn, their pumpkins, and their beans; the rivers were filled with salmon, shad, and other fish; the woods and hills abounded with every kind of game for food and for clothing; and the swamps and forests yielded grapes, berries, nuts, and all the native productions of a temperate climate.

This was their country, their home; and for a hundred years these red warriors defended it from invasion with a fiery courage and a desperate devotion, which, in any other people or nation, would have been called an inspired patriotism, but which met with as little sympathy and consideration from our Puritan fathers in the Province of Massachusetts Bay, in 1679, as is shown by their descendants two

hundred years later, in the hills and valleys of Colorado and Nebraska.

The earliest town settled in this county was Deerfield, in 1663, then Northfield, Sunderland ten years later; Greenfield, Montague, and New Salem came next; and the remaining towns, down to the close of the last century, were incorporated, being made up of offshoots from the older towns about here, —from Dedham and its vicinity; while many of the best families in our county trace their ancestry back into the sister-colony of Connecticut, which was early settled with brave, God-fearing men, who never failed us in time of need.

In 1799, the county being pretty well populated, it was thought desirable to have better communication with the cities of Boston and Albany and Troy; accordingly, a turnpike was built easterly to connect with Boston, and, in 1802, westerly, toward Troy and Albany.

In order to make the Connecticut River navigable for flatboats, in 1794 a dam was built at Turner's Falls; and a canal three miles long, to avoid the falls and rapids, was dug down the river through what was called Montague City. A company of Dutch from Saybrook, believing, that, at the completion of the canal, it might be made a place of great importance, bought the land, laid out streets and city lots. Events did not justify their expectation. The canal for more than fifty years did a large business, but left no great results on its line. Railroad transportation has dried up the canal, which has become like Tadmor in the wilderness; and a couple of dozen of neat cottages constitute the "City."

In 1846 the Connecticut-river Railroad was built through the county from the south; in 1850, the Vermont and Massachusetts from the east; from the west, about 1876, after a parturition of nearly thirty years, came to us the Troy and Greenfield, a child of many prayers.

The only public institutions in the county are the jail and court-house. We have never been favored with a lunatic-asylum, a reformatory school, state almshouse, college, normal school, nor any other State institution, partly because we are out of the way, and partly, perhaps, from lack of persistency in asking governmental favors.

Franklin County covers about six hundred and fifty square

miles, with all the variations of soil found in New England, except salt-marsh.

The alluvial soil of the valleys of the Connecticut and Deerfield Rivers is unsurpassed in fertility. The Deerfield meadows embrace about three thousand acres, most of which is overflowed in the spring. The soil of the eastern half of the county, off from the river, is of a harsher quality, largely underlaid by granitic or sienitic formation, and it is not in general so well adapted for good grasses or grains as that on the western side, where, between the hills and ridges, are fertile valleys of a rich, unctuous soil; and the spurs of the Green Mountains, of argillaceous and micaceous slate, afford the earliest and sweetest pasturage, from which in by-gone years went the heaviest cattle and fattest lambs that graced our Brighton market.

There are in the county 3,956 farms, the average acreage of which is 88. We have about 80,000 acres of cultivated land, and we have 20,517 of unimprovable land, — more than any other county in the State; but our agricultural products are fully up to our proportion of the cultivated land.

The population of the towns composing what is now the county was in 1776, 10,294; in 1811, when organized into a county, 27,421; and is now only about 35,000.

An examination of the census-returns for the last fifty years shows curious facts, and gives opportunity for speculations which neither time nor this occasion allows us to follow out.

The changes of population, and the depopulation of the hill towns of our State, are subjects of curiosity, and indeed almost of anxiety. Attention was called to this in the excellent message of Gov. Talbot last January; and I think it would be very pertinent matter for this Board to examine, to collect facts, and show effects, even if the causes cannot be very satisfactorily explained, and even if no remedy can be found to arrest this fleeing from the hill country.

It may not be uninteresting to mention some of the eccentricities of population in this county. There are twenty-six towns. During the past fifty years, seventeen have lost 5,119, and nine have gained 9,246; the county as a whole having increased 4,127. Of these seventeen, all but three are "hill-towns." Gill, Northfield, and Whately, though on the Con-

necticut River, have made small losses of about 450 in all. Of the nine towns which gained, all have railways traversing them: the others had not in 1875, except Whately and Northfield.

All which have gained have unquestionably done so on a manufacturing population, with the exception of Sunderland, which without a railway, or any special manufacturing interest, has gained 194. On the other hand, the only two manufacturing towns which have lost are Coleraine and Conway, which are and have been from four to six miles from railway communication.

Heath and New Salem have less than half the population they had fifty years ago and more, the latter town being, in 1810 and 1820, the largest in the county, with over 2,100 inhabitants, now having less than 1,000.

The populations of Bernardston and of Charlemont have neither of them varied a hundred in any census for half a century.

The changes in the productions of the county have been almost as great and varied as its population. For years it was famous for the fat cattle, sheep, and hogs which went to Brighton, our only market: in those days, instead of horses, we used oxen, and fattened them, feeding with an unrestricted hand the yellow corn from hundreds of acres now sacrificed to the seductive tobacco. Nor has the sceptre altogether departed from our hands, seeing that — although we have within our limits more unimprovable land than any other county, that we are the fourth in acreage, and the fifth in amount of cultivated land — we send more fat early lambs to market than any other county. We are exceeded in pounds of beef and in pounds of butter only by the great county of Worcester. Only two counties send more pork, and only one as much fatted mutton; and we grow more wheat than all the rest of the State of Massachusetts. The extension of long lines of railways, bringing from the Far West cattle, sheep, and swine, and even corn, almost as cheaply as we can raise it, has greatly changed our condition. These changes will be noticed by a comparison of the returns of domestic animals and crops, from the Federal census of 1840 and the State returns of 1875.

Domestic Animals.	1840.	1875.
Neat-cattle	28,794	21,902
Horses	4,288	4,098
Sheep	61,210	11,318
Swine	11,352	3,441
Poultry, value	$9,678	$31,155

Crops.	1840.	1875.
Wheat, bushels	21,489	7,456
Rye "	68,635	21,957
Oats "	149,578	30,145
Indian corn, bushels	161,338	154,310
Potatoes "	422,599	254,528
Broom corn, pounds	–	13,574
Hops, pounds	20,047	355
Hay, tons	43,853	61,056
Wool, pounds	142,386	42,680
Tobacco "	600	1,997,091
Dairy, value	$165,765	$424,042
Orchard food, value	$26,295	$130,722

From the incompleteness of the Federal census of that date, it is impossible to make close comparisons with the minute and carefully prepared tables of our State enumeration of 1875.

Although we seem to have lost greatly in the large staples of domestic animals, grains, and roots, yet a careful examination would show us in a better condition now than then.

The increase on the five items of hay, tobacco, dairy, orchard, and poultry, amounts to about one million dollars. The reduction in the number of sheep is the greatest loss we mourn. But there is some compensation even here. Our sheep are more valuable individually. While wool that we grow now is worth about as much per pound as it was then, we have increased the weight of the fleece about a pound each; while then they didn't count more than one lamb to be raised from two ewes, we now, with the care we take in selection, breeding, and feeding, reckon a lamb and a half to each ewe; the lamb then, at three months old, worth a dollar, now brings seven dollars. The decrease in the num-

ber of sheep is largely due to the fluctuation and depression in the price of wool (more especially fine wool), and the impossibility of competing with the owners of the broad plains and enormous ranches of the West and South.

Probably at that time more than three-fourths of all the sheep in the county were Merinos or Saxonies: now there is not one-fourth. The wool has became a secondary consideration, while mutton and early lambs claim our first attention. We send annually about ten thousand lambs to market, at an average, from May to September, of over five dollars each. The wool of our coarse and middle woolled sheep is worth as much, sheep for sheep, as that from the fine wools.

We have the Downs, and some large moderately fine wool sheep, which may properly be called American Merinos, — crosses of various breeds with the large French Merino, probably, where the predominant antiquity of the Merino blood has been so broken down and controlled as to make a large, good-shaped, well-woolled sheep, giving good early lambs. The Cotswolds are now being a good deal introduced for crossing for lambs.

The great obstacle now to sheep-growing here, as in other parts of the State, arises from the ravages of unrestrained dogs, which, roaming generally at night or early morning, too often cause havoc in a flock, killing some, mangling more, scattering and demoralizing the whole flock for the season.

In all our animals there has been a great improvement by adopting improved breeds, and cultivating them. Attempts have been made, but without success, to introduce and popularize the Ayrshires, the Devons, and the Herefords; but the grandeur of the Short-horns has overshadowed them all.

About thirty years ago the Jerseys were first brought into the county; and as the making of butter has gradually and greatly increased, so has the use and breeding of Jersey cows and their grades, till they now rival in numbers and popular esteem their majestic sisters which sprung from the Valley of the Tees in the fertile county of Durham.

The first agricultural society in this section was the old Hampshire, Franklin, and Hampden, covering these three counties, organized in 1818, and for many years the only society, and very successful.

It was, however, felt that it covered too much territory, and that Northampton, the usual place of holding the show of stock, was too remote for the farmers of Franklin County to drive their cattle for exhibition. Accordingly the Franklin-county Agricultural Society was incorporated in 1850, held its first cattle-show in Greenfield Sept. 25 of that year, where its shows have since continued to be held, as exponents of agricultural prosperity, liberal display, and a sound public sentiment.

In 1860–62 the society purchased ten acres and a half of land in this village, most admirably adapted for the purposes of a show-ground, except that it was hardly large enough. It was a well-turfed, smooth meadow, bounded on the south side by the highway; while on the northern side, hills, rising with a gentle slope some seventy-five feet, swept around, forming a beautiful and convenient amphitheatre. Stands, sheds, and pens were erected, and a short track laid out. These grounds were used by us with great satisfaction till the construction of the Troy and Greenfield Railroad over part of the land made it necessary for us to purchase elsewhere, and we accordingly bought a tract of thirty-three acres on an elevated plain, about half a mile south-west from the railway station, with a dry, sandy, well-drained soil, and having within its limits a very pretty grove, and being very accessible. This land has been enclosed with a high, substantial fence, an admirable track of a full half-mile constructed (said to be the best in the State), a hall, covered seats, horse-stables, and cattle-pens built, and running water introduced, the whole at a cost of between nine and ten thousand dollars. We now number about twenty-five hundred members, have a small debt of about fifteen hundred dollars, which is annually reduced about five hundred dollars. We pay from seven hundred to eight hundred dollars for premiums each year.

Our show is strictly an agricultural one, although our receipts would be much increased by the attractions of balloon-ascensions, foot-races, base-ball games, horse-trotting, and pool-selling. We have generally believed it better to hold to the words of our charter, and the spirit of our act of incorporation, for the improvement of the agriculture of the county.

Nearly all of the modern breeds of cattle have had the encouragement of the society's premiums; but only the Shorthorns and Jerseys have retained any strong hold among our farmers.

Of sheep which we breed to a considerable extent, the Saxonies and Merinos have had their day with us, and have passed away, giving place to the Downs, the Cotswolds, and American Merinos, — sheep for feeding, and for raising early lambs, without much regard to the fineness of the fleece.

Of swine we have had the Berkshire, the Chester Whites, the Essex, the Magie or Poland China, and the Suffolks, all of which have breeders and defenders. Attention has recently turned to the Yorkshires, some of which were imported by the Massachusetts Society for Promoting Agriculture, as a very superior breed.

In 1870 the farmers of the western part of the county, feeling that they were too far from the county-seat, and separated by a mountain-range, organized themselves, without any opposition from the parent society, into another, called the "Deerfield Valley Agricultural Society," comprising some eight or nine towns. They purchased seventeen acres of beautifully located land in the village of Charlemont, erected convenient buildings, and have from their commencement, in 1870, held regular and successful fairs. In each of these societies is a farmers' institute, which meets regularly through the winter, having essays, and free and interesting discussions.

The Franklin Harvest Club was organized at Greenfield in 1859, and, though originally intended to be confined to twelve members in the immediate vicinity, has grown to large dimensions, numbering some thirty members, whose farms extend from the State line of Vermont on the north, to that of Connecticut on the south.

This club meets fortnightly at the homes of the different members, where, after inspection and criticism of the premises and stock, agricultural papers, often of a high order, are read, discussions and experiences follow, and the proceedings are closed by a plain farmer's dinner.

That the influence of this club during its twenty years of existence has been greatly beneficial, not only to the members, but to a wide extent beyond, cannot be doubted.

In this town a farmers' club was founded in 1856, which has continued its organization to this day, its members earnestly assisting at this meeting. Farmers' clubs have been established in other towns and school districts, many of which have been useful, and will renew their organizations as the winter advances. The members of these societies and these clubs are the men who now welcome you here to-day, and who show to you, by their presence and attention, that they appreciate the efforts of this Board to improve and elevate the character of our agriculture, which is our common object.

It is foolish to write or speak of the glories or the beauties of a farmer's occupation. It is to a considerable extent independent; it is eminently respectable, and absolutely necessary: but it is not beautiful, it is not easy, nor very profitable; but, as we and all live by it, we seek to better and to lighten it. A thousand years before the Christian era, the wisest Pagan philosopher said, "He who sows the ground with care and diligence acquires a stock of religious merit greater than he could gain by the repetition of ten thousand prayers."

The meeting then adjourned until two o'clock.

Afternoon Session.

At two o'clock, the meeting was again called to order by Mr. Grinnell, who introduced as the first speaker John M. Smith, Esq., of Sunderland.

THE HUSBANDRY AND COMMERCE OF NEAT-STOCK AND ITS PRODUCTS.

BY JOHN M. SMITH.

It is but a short time, a few years, since our New-England farms in their state of virgin richness bore abundant crops, and the agriculture of the east was self-supporting. We raised our own corn, wheat, and beef; from our own productions were manufactured our clothing: in fact, every commodity necessary for our use was grown at home. It is within the memory of many still living in this county, when to buy wheat-flour was a thing unknown, except it may be a

few pounds of "Baltimore flour" for the annual Thanksgiving. Butter and cheese were made in every farmer's household. Horses, cattle, and sheep were raised in abundance for home use and for market; and every thing which appertained to farming was in a prosperous condition.

To-day the soil, in many of our eastern towns especially, has been robbed of its fertility. Farms have been sold in driblets and by the wagon-load: yes, even by the shipload is this now going on, the exports of farm products for the year ending July 1, 1879, amounting to five hundred million dollars. They have been carried off by rail and team, driven on foot in the shape of horses, cattle, and sheep; and soon we shall have to vacate the premises ourselves, or adopt some system whereby we can with economy restore our wasted resources. The question arises, How? What method shall we adopt to restore our farms to fertility, and at the same time provide for the wants of those depending upon us, and possibly "lay up something for a rainy day"?

The fertility of these run-down farms may be economically restored by systematic grain-growing, cattle raising and feeding. The system of cattle-raising pursued in the vast grazing-regions of the West and South-West may not be applicable to New England. Although the Western graziers may be able to make their sixty or a hundred per cent profit, yet it is not true, as is too generally considered, that the stock-growing in the older States must be abandoned for the reason that the high-priced lands of the East cannot compete with the cheaper lands of the Western States and Territories. Whatever changes may be required in the practice of agriculture in the older sections, in view of the competition of the rich corn and grass lands, which, by a mistaken policy, are being forced into occupancy in advance of the necessities of the people, it is obvious, that, so long as the land is used in the production of crops, the grazing and feeding of live-stock cannot be dispensed with.

This is demonstrated by the practice of the farmers of Great Britain, who, notwithstanding the high price of land and all tillage crops, pay more attention to stock-breeding than any other people in the world. The course of agriculture in our own country teaches the same lesson. It was not long ago that the feeders of the Great West grazed their

cattle on the prairies of Illinois, and predicted in a few years this great State, with its matchless soil, would be able to break down prices so as to render the business unproductive in the older States; just as we heard, but a short time since, that Texas and the Territories would soon grow beef for the whole United States. But what have been the actual facts? Illinois, though surpassing the most sanguine expectations as a corn and grass producing State, had, according to the last census, less than one hundred and fifty millions of dollars invested in live-stock; while the old State of New York had nearly one hundred and seventy-six millions. The live-stock of Missouri was reported at the same time as worth eighty-four millions; while that of the old Keystone State, at more than one hundred and fifteen millions, and Ohio at one hundred and twenty millions. It is also noticed, that while the Western States are rapidly increasing in live-stock, as in all other products of agriculture, the older States are making very respectable progress. Thus while Illinois, between 1860 and 1870, added seventy-seven millions to the value of her live-stock, New York, during the same period, added seventy-three millions. The increase in Pennsylvania during the same period was forty-six millions, while in Missouri it was only thirty-one millions.

These facts are significant as indicating the prominence which this great interest has, and must continue to maintain, in American agriculture. It is therefore safe to assume, that in the future, as in the past, the prosperous farmer will be the man who handles most judiciously his live-stock; for it is unquestionably true that while this branch of industry is, if properly managed, the most profitable, as it is the most interesting, connected with our vocation, it is most disastrously unprofitable when the management is bad. If, for breeding or milch cows, inferior animals or inferior blood are procured, the result cannot fail to be disastrous. If we select a good cow, one that will give a fair quantity of good milk, and of such form and blood that her calves will be worth raising, and that can be converted into a good carcass of beef when no longer wanted for breeding or for milk, we shall have made the most profitable investment that pertains to legitimate agriculture; while a cow with qualities the reverse of all these will be the most unprofitable that could be selected.

The importance of using thorough-bred sires impresses itself upon the mind of every thoughtful stock-grower.

Our native cattle have no uniformity: they are made up of incongruities in size, shape, color, and quality. They have no fixed or permanent character, but possess various qualities of blood, with no particular characteristics which can be depended upon.

By the use of a thorough-bred bull with a fixed character and blood, his blood will be thoroughly infused into his offspring, so that they will partake of his own quality and appearance. Let this course be repeated upon the next generation, and the blood will become stronger in them, till, by continued crossing, the thorough-bred blood is shown in the progeny, beyond dispute, to the inexperienced eye. As to the pecuniary advantages derived from this course of breeding, there can be no question. One writer says that there is a difference of two hundred pounds of meat in a steer at three or four years old, in favor of the use of thorough-bred bulls, worth at least ten dollars; and, in fact, such a steer will often sell for fifteen dollars, or more, more than a common steer. And, if there may be so much more profit in individual cases, who can compute the addition made to the amount of meat, if this manner of breeding were pursued all over the country? Further proof of the increased profit to be obtained, if this manner of breeding were pursued, can be seen in the fact, that, of the number of cattle exported from this country in 1878, the Spanish stock sent to Cuba, and numbering one-half of the whole, were valued at seventeen dollars per head, or \$683,000; at the same time three-tenths were sent to Great Britain, valued at ninety-seven dollars per head, and a total of \$2,408,000.

These facts convince us of the importance of securing proper animals to breed from; but, having done this, much depends upon the manner of feeding the young stock. Stock fattened from birth will make the most profit when slaughtered at two years or two years and a half old. Good judgment, care, and skill are required, in order to meet with the fullest success. The Western feeders have certain advantages over us, that ought to be counterbalanced by a better system in the East.

It is said to be an established fact that the young animal

takes the least amount of food to make a pound of growth; and, all things being equal, each succeeding pound of growth, up to maturity of the animal, costs more than the preceding pound.

For the purpose of making beef, milk, or butter, it is not absolutely necessary that the dam be a thorough-bred; but she should be a well-formed cow, with other desirable qualities, and a thorough-bred sire should be used. The calf should be dropped in the autumn months, and in forty-eight hours taken from the cow, and fed with whole milk, say two or three weeks, and for a week or two longer upon half whole and half skimmed milk, and brought gradually to be fed wholly upon skimmed milk. When a few weeks old, commence to feed wheat-bran, gradually increasing to a quart a day. A little linseed-meal is very desirable, furnishing another variety; a few roots chopped fine also will help to keep the bowels in good order. If the calf is inclined to scour, give him scalded milk and a handful of finely ground corn-meal.

But in the opinion of the writer, excepting linseed-meal, nothing is quite so good as milk and wheat-bran fed separately. Upon five or six quarts of milk per day, one or two quarts of wheat-bran, and a little hay, the calf can be cheaply kept till grass, when, if allowed to run in a good pasture through the summer, he will be as valuable as if born in the spring, six months earlier, and reared at greater cost. During the second winter it is not necessary that an animal now a little more than a year old have the best hay, but it can be kept on a second quality of hay by continuing the use of the bran.

As to the cost of the creature till two years old, we make the following estimate:—

Six quarts milk per day for three months (90 days), at 1 cent	$5 40	
Four quarts milk per day once a day for three months	3 72	
One quart bran per day, say 200 pounds	2 00	
Two hundred pounds hay	1 50	
Pasturing twenty-six weeks at 10 cents	2 60	
Cost at one year old		$15 22
During the second winter one ton hay	$10 00	
Wheat-bran	4 00	
Pasturing twenty-six weeks at 16⅔ cents	4 33	
Cost at two years old		18 33
		$33 55

The cost of keeping has been reckoned at its market-value in this vicinity, which cost might be lessened in those localities where the value of feed was less.

It is not a very difficult matter to raise a creature, which at two years of age shall be worth the above sum, even at the present market-value of beef; not a very difficult matter to raise a steer whose live-weight at two years of age shall be ten or twelve hundred pounds: and in what better way can the farmer dispose of the produce of his farm than to such kind of stock? I have estimated the cost of raising neat-stock up to the age of two years, and no further; because it seems to me, that, after this age, the value of the heifer and steer, if kept for beef purposes, is no longer equal, the heifer, under ordinary circumstances, coming to maturity sooner than the steer. And if dairying is one of the pursuits of the farmer, as we contend it should be, then arrangements have been already made to have the heifer new milch at two years or two years and a half old, from which time she will pay in milk for her yearly keeping, till four or five years of age, increasing in value herself at the same time. I have been somewhat minute in the above matter of the cost of raising neat-stock, because I am confident that there is profit in it.

But it is our purpose in this paper to make a presentation of facts showing something of the great amount of capital employed in the husbandry of neat-stock in this country, and in the commerce of the products of this industry; showing, also, the importance of the export trade of neat-stock and its products to this country, — a trade yet only in its infancy, but which shows such encouraging signs of future promise, commencing as it did when there was an over-supply of these products, gathering and affording an outlet for vast quantities of our surplus, which we are glad to learn is as gladly received by the Europeans as we are glad to exchange it for "British gold." And an anxiety on their part has been manifested, lest the supply should soon be exhausted, they themselves being unable to provide a requisite amount for home consumption; and in consequence the prices have ruled so very high, that the poorer classes are unable to provide it. We learn that thousands of families of the middle classes of England are unable to obtain suffi-

cient animal food because of the high prices. American meat brought to their stores sells from six to ten cents a pound lower than the price asked for English beef; and a suspicion is entertained that not a few butchers sell American for English beef at the advanced rates.

The shipment of fresh meat to England, we learn, was begun by one Timothy Eastman; and his first lot consisted of forty-five cattle and fifty sheep in October, 1875. At the close of 1876 and at the beginning of 1877, his shipments amounted to from six hundred to a thousand per week, and have continued till he has opened markets in a number of the principal cities of Great Britain. The cost of shipping fresh meat to England has been reduced since its commencement. At one time it required one ton of ice to every two thousand pounds of meat; but, owing to improvements in refrigeration, the quantity needed is much smaller. The average steamer freight now for live cattle is seventeen dollars and a half per head, or from twenty to twenty-five dollars, including all costs and commissions on the other side; but, with this addition to the cost at home, it is said that American beef sells in Liverpool at about the same price as at Boston.

The question which interests American farmers is as to the permanence of this foreign demand. The best proof of the strong hold that American beef and mutton has upon the British public, and of the permanent character of the traffic, is the fact that English capitalists and traders are preparing to engage in the business on an extensive scale; and already arrangements have been made for the shipment of Texas cattle from Galveston direct to England, instead of by the usual route of driving and freighting across the country, and thence by steamer from New York or Boston. We learn that the steamship "Great Eastern" has been fitted up for this purpose. The fact of the safe arrivals of whole cargoes of live-stock without loss has become established, and is no longer an experiment. One writer has said in regard to this whole subject, that "the meat question, in connection with stock-raising, has resolved itself into one of the most important questions in the realm of agriculture. Wheat, corn, oats, and other cereals are important crops; but stock-raising, in reference to the future supply of meats,

not only for domestic purposes, but for foreign demand, has become an important factor among the elements of our great sources of national wealth." In fact, it may be confidently said, that stock-raising has a prospect before it which presents opportunities not only for capitalists, but for small farmers, which are not surpassed by any other branch of productive industry.

The production of animals in the United States, already phenomenal in its extent, is increasing every year, and it is encouraging when we consider that this increase is not confined alone to the numbers of cattle, but appears also in weight and quality.

"The Mark Lane Express," in writing upon this point says, "The improvement rapidly going on in quality alone will likely double the value of the numbers quoted." Another writer says, "Whatever the number, more beef is produced than ever before, and, further, by better feeding, the *time* required to bring them to maturity being reduced, increases the amount." In regard to the amount of meat sent abroad during the past year, it is stated that there was exported, of fresh beef, fifty-four million pounds; of salt beef, thirty-eight million pounds; of preserved meats (largely beef), a value of five million dollars, besides eighty thousand cattle,—in round numbers three hundred thousand cattle exported in a year. Almost every steamer that has left New York for Liverpool during the last year has taken as a part of its cargo a hundred tons, more or less, of fresh beef properly refrigerated. While Liverpool steamers sailing from Boston, Philadelphia, and Baltimore, also take large quantities of the article, so perfect has become the art of refrigeration, that dressed cattle are now shipped from Chicago to Liverpool direct. A beef creature properly subjected to the conditions involved in the improved system of refrigeration will keep seven or eight weeks; and epicureans know, that, the longer fresh meat can be kept perfectly sweet, the more tender and juicy it becomes.

Our English cousins enjoy, then, the privilege of buying tender American beef, and, it is said, at a less price than the same cuts are sold for in the American markets. Where beef is shipped direct from the West to Liverpool, the rates of freights are less, or lower than they otherwise would be,

owing to the competition both between the trunk railroad lines and the ocean steamship lines. Does this large exportation affect our own markets? Does it affect the price of beef at home? There can be no question but that the shipment of four or five thousand of our best cattle out of the country each week must have, and has had, an appreciable effect upon our markets. We think it not the least exaggeration to say that the price of beef at home has been held up at least one dollar per hundred, in consequence of this new traffic. It is generally thought that the Western States only, can furnish the kind of beef required for this trade, which is not the fact. We quite often hear of some lots being sent from the New-England States, and even from our own Connecticut-river Valley. Not long ago we noticed that a stock-dealer shipped twenty-six head, valued at two thousand dollars, from near Concord, N.H. There is no reason why the West should monopolize the shipment of either live or dead beef to Great Britain. New England is capable of producing cattle for foreign export at remunerative prices, and we hope to see an increased attention paid to the raising of cattle for the export trade.

It is plain that the only way to meet with success in this direction would be by breeding from the meat-producing breeds. We have as yet alluded only to the benefits arising from the raising of neat-stock for meat production, intending hereafter to notice some of the products, including those of the dairy, which, when manufactured, in connection with the production of meat, may be made profitable to the New-England farmer. It was not our intention to advocate the merits of any particular breed of cattle for its accomplishment, but in the preceding sentence we have advised to breed from the meat-producing breeds. In this connection we may express our regret that those in authority at the Massachusetts Agricultural College felt obliged to take steps which led to the sacrifice of their Short-horn stock.

There is one branch of the export trade in cattle which is comparatively new, which has sprung up between some parts of Europe and the United States. We allude to the exportation of lean cattle to Germany, which bids fair to become a very lucrative business to both countries. We have gleaned a few facts from one of the agricultural journals, which are

worthy of presentation. One of the provinces of Germany has long been famous for its rich and fertile pastures, which are not surpassed in any part of the world. Every year this province has grazed and fattened thousands of cattle for exportation to England and France; and the beef so produced has always commanded higher prices than those fattened in any part of Europe. As but little stock has been bred in this province, the graziers have depended chiefly for their supply of lean cattle on Denmark; and in consequence of the growing demand, and the rise in beef, lean cattle have become scarce and dear in Denmark. Some of the leading cattle-graziers despatched a steamer to New York for a cargo of cattle, which were purchased in Chicago. The steamers returned within six weeks from the date of sailing with a cargo of three hundred and twenty lean cattle, fifteen horses, eighty-six fattened hogs, and a hundred and four fattened cattle. The cattle suffered very little from the sea-voyage, were landed in excellent condition, were sold at high prices. The cattle were purchased at much lower rates than they could have been in Denmark, and compared favorably with the Danish cattle. The parties interested in the project were so much pleased with the experiment, that they determined at once to send the same steamer for another cargo as soon as she could be made ready for the voyage. If these cattle prove to fatten as readily as the Danish cattle, and their exportation is not restricted by the government, it will add another branch to the trade in the products of American soil.

It will be remembered that there has been considerable preference shown in favor of the exportation of live cattle from the United States and Canada, which was manifested by the act passed by the British Parliament, requiring that all cattle brought into England should be slaughtered at the port of entry, except such as came from the United States and Canada. The cause of this discrimination in favor of American live cattle arose from the fact that all live cattle exported from western Europe are peculiarly subject to the rinderpest, a contagious disease which has caused great destruction among some herds. Considerable anxiety and excitement prevailed throughout our country early in the season, in reference to the presence of the cattle-disease among our cattle, which at present has subsided. Although

the English Government have placed some restrictions upon the entrance of cattle into their country, yet we are happy to say, that, under these restrictions, the exportation traffic is being carried on, and in fact it has been steadily increasing. It was said at the time of the appearance of the disease, that its cause was owing to long exposure of cattle on account of storms while they were being transported by rail. It was said further, that the extent of the disease was magnified by those whose trade had been unfavorably affected by our exportations. Be this as it may, it can but be desired by every one interested in this great national industry, that every vestige of these diseases, of whatever type, may be effectually stamped out. We rejoice to learn that stock-growers are stirring in the matter of bringing before our National Congress the necessity of the enlistment of the government in the matter, and the need of an appropriation for the prosecution of the work of cattle-disease extermination; and it is desired that the Massachusetts Board of Agriculture may present this matter to our Legislature, that they may be led to urge upon Congress immediate action.

The British secretary of legation at Washington has recently communicated to his people a statement of the cost of agricultural produce in the United States, that the government might know what to expect in the future from the import of American food. He says as to the future prospects of the cattle-trade, "If the present restrictions in England were removed, and the cattle from the United States were allowed to be landed alive, the trade would increase enormously, since, notwithstanding many obstacles, the shipments have shown a substantial increase this year."

American cattle have been selling in Liverpool at a very handsome profit on the cost, and, so long as a remunerative market is open, the trade will increase, since, with the vast stock-raising lands of the West, there is practically no limit to the exportation.

The rapid increase in the export trade of cattle can best be realized when it is considered that the trade, although it had been established but two years, reached in 1877, embracing meat and live animals, an aggregate of over $8,000,000, and for the year ending July 1, 1879, $11,487,754.

The shipments for 1878 were $80,000; for 1879, $136,000.

The amount of capital invested in horned cattle in our country is estimated at nearly $1,000,000,000. A fair estimate of the number of our meat stock at the present time would be 35,000,000, although some estimate it as high as 40,000,000.

In 1840 it was computed that there were 14,971,586; in 1850, 18,678,582; in 1870, 28,678,000; in 1872, 26,989,000; in 1873, 26,923,000; in 1875, 27,870,700; showing that in 1872 and 1873 the number decreased 1,500,000, owing to the fact that cattle could not be raised at profitable rates, as the supply exceeded the demand.

What are known as "native" cattle of America have sprung from the stock of the parent countries, which successively contributed to the colonization of the New World. In the older States of the Union the common stock is a mixture descended from different kinds of English, Dutch, Swedish, and Danish cattle brought to the Atlantic shore in the seventeenth century, the English predominating.

They have, of course, been modified by the changes in climates in which they have lived and bred. The "natives" cannot, therefore, properly be compared with any old and distinct breed.

In the South-West, the Rocky Mountain region, and on the Pacific slope, are found the descendants of the Spanish cattle introduced into Mexico three hundred and fifty years ago: these preserve many of their original characteristics. They are tall, lean, lank, and bony, flat-sided, high in the flank, and often swayed in the back; heads coarse, with long and wide-spread horns, with points outward. The colors are black, dark brown, brindle, reddish brown, light yellowish red, and occasionally a gray, nearly all with more or less white upon them. The cows are almost as large as the oxen, and of similar appearance: they furnish the calf with a scanty supply of milk, and that for only twelve or fifteen weeks from birth. They have half-wild natures, and are impatient under restraint. Professor J. P. Sheldon of the Agricultural College of Cirencester, Eng., says, in regard to these Texan cattle, "Centuries ago the Moors of Andalusia reared large herds of awkward, lanky, long-horned cattle, some of which were taken across the Atlantic by the Spaniards who discovered Mexico, and afterwards settled in

Texas. These cattle have been so exclusively reared ever since, that the Texan cattle of to-day may be called full-blooded Spanish, and they may be said to have inherited all the characteristics of the original stock." On the vast plains of Texas these cattle become, to all intents and purposes, wild cattle; and even yet, some of our herds are in a half-wild state, so that it is unsafe for a man on foot to venture amongst them.

These Texan cattle are sent in considerable numbers to the corn-raising districts to be fattened. Few however, if any, of the pure wild bred stock are sent, they being of very inferior quality, difficult to fatten, and not very valuable when fat. Great efforts are being made to improve these cattle, by crossing them with the short-horn cattle.

The herds of cattle of the Western and Southern country have increased marvellously within a short time.

It is only about eight years since the cattle men began to put their drives out upon their pastures to graze: now there are hundreds of herds numbering from a thousand to fifty thousand head, and we have learned of one firm which owns a hundred thousand cattle, and of one single individual who owns ninety-six thousand cattle; while the acres of these herdsmen number from a hundred thousand to five hundred thousand.

It is stated that the immense possibilities of the export trade in cattle have induced William H. Vanderbilt, the railroad king, to head a great enterprise for this purpose, and he has declared that it shall be a magnificent success, if money will do it.

It may be interesting to notice some of the great markets for this production, and their rapid growth.

Twenty years ago 150,000 beeves were received at New York; and New-York State ranked first in furnishing the supply for the city market. In 1860, her receipts were 227,000; in 1865, 273,000. In 1875, Illinois and the States farther West were credited with furnishing half of the supply. In 1868, New-York State still held the second place as regards the supply, and Texas contributed 10,000 beeves. In 1874, Illinois was credited with supplying one-half, and Texas 75,000, of the 451,000 cattle received. In 1876, 470,000 cattle were received; in 1877, 505,217; in 1878, 544,371 beeves,

4,113 cows, 133,573 calves, 1,341,502 sheep; in 1879, 568,548 beeves, 7,400 cows, 155,890 calves, 1,508,254 sheep. At Chicago, the cattle sold in 1855 numbered 10,000; in 1865, 333,000; in 1870, 533,000; in 1879, some over 1,000,000. But as Chicago is a distributing market, probably three-fourths of them are shipped again for Eastern markets.

At Boston the receipts for 1877 were 156,000, seventy-six per cent of which came from the West.

We have already said something as to the permanence of the foreign demand for our meats; but it is an interesting fact for the farmers of this country that the possibilities and probabilities of this new trade have aroused a fear in England, lest the importation of meat into England may unfavorably affect the prospects of the British farmers.

Professor Sheldon, to whom I have already alluded, writes, "Since the days when the repeal of the Corn Laws in England was advocated by the far-seeing men of that period, few things, if any, directly touching the interests of agriculture in this country, have been so widely discussed, or have produced in certain quarters so much apprehension, as the importation of American meat. Amongst the dairying and meat-producing farmers of these islands, whose prospects were immediately affected by it, the subject of American meat produced for a time something closely akin to a scare; and settled apprehension remains in the minds of many, that British stock-farming has been shorn of much of its present and future prosperity."

But Professor Sheldon takes another view, viz., "that the agriculture of England will adapt itself to new conditions; and if, as some say, we (England) are up to our limit of meat production, then there is room for American meat to come in," and he goes on to say, that if the estimate of "The London Times" is true, that the population of England shall double in fifty-four years, and in five generations become two hundred million, then they may congratulate themselves that there is American meat to fall back upon. And Professor Sheldon goes on further to say, "that America is already in a condition to send us very much meat; and not only that, but she is able to multiply the amount from year to year almost indefinitely." America has nine acres of land in farms (exclusive of the acres in forests) to

every head of population, and about three head of cattle to every four of population; while, in Great Britain and Ireland, there are about three-fourths of a cultivated acre to every person, and only one head of cattle to every three inhabitants; or, as put in another form, in the United States there are for every hundred persons seventy-five head of cattle, and these have five thousand acres of land. Some idea may be formed by this, of the capacity of this country for the production of animal food.

In a recent publication I saw the following statement: Great Britain numbers thirty-three million in population, of whom, it is officially, stated eighteen million can be sustained on food grown at home, leaving fifteen million to be supplied from foreign sources. Statistics show that the United Kingdom annually imports a hundred million dollars in value of food, thirty-five million dollars of which is for live animals.

The British Isles contain now six million cattle, twenty-eight million sheep, two million five hundred thousand pigs, or less than one-sixth of a steer, one-twelfth of a pig, and less than one sheep, to each head of population; and this for a people who are fast increasing their average consumption of meat.

The question naturally arises, From whence are they to be supplied? France, it is found, is hardly able to supply herself with animal food: in fact, it is stated that the price of meat was higher in Paris than in London and in corresponding markets. The writer to whom I have alluded, the British secretary of legation, says that "the United States is destined to supply England with her main supplies of food," since he finds it the very nature of American enterprise to push a trade which affords a profit, and to resort to all manner of cheapening processes and methods to make it more profitable, and that this great traffic in cattle is to be one of permanence and profit.

I read some months ago, in one of the leading agricultural journals of the State, a paper upon one of the industries of the country, which, as it treats upon one of the products arising from the "Husbandry of Neat-Stock," and one in which every farmer is more or less interested, I cannot forbear giving a few extracts. It was written by Andrew J. Lawson, and was about "Hides," transactions in which have

become a very important feature of our commerce. "The manufacture of tanned leather, and tanned and dressed skins of different kinds, and their conversion into the numerous purposes of elegance and necessity, have attained in this country almost the first rank as a branch of national industry. The article of hides is not only the basis of this great industry, but is the indirect agency of bringing into play other important industries, among which are the manufacture of tallow, hair, soap, glue, bone-dust, ivory-black, animal oil, &c.

"It is estimated that at least 35,410,000 pounds of tallow, and fourteen million dollars' worth of neat's-foot oil, candles, and glue, are realized from the animals which are slaughtered that furnish the hides that annually enter into the commercial transactions of the United States. The imports of hides and skins in 1876 embraced some five million hides, including a million from Buenos Ayres, and half as many more from Rosario. The west coast of Africa furnishes the United States with a large number of hides.

"Other countries, including Sierra Leone, Bolivia, Zanzibar, and Mexico, furnish our leather manufacturers with some of the best hides in use. The hides of animals obtained in the tropics do not make so good leather as those of the temperate latitudes.

"The number of hides imported at New York for the first eight months of 1876 were 2,134,163, at Boston, 1,035,855." The writer of this letter says, in regard to the practice of the Texans of branding their cattle, "Texas cattle receive six different brands, representing as many leading firms in the business.

"This practice destroys millions of dollars in the value of the hides; but the dealers in cattle care more for the raising of cattle for beef than they do for the hide: hence the mutilation of the cattle without regard to the hide. The frequent branding of cattle is also a cruelty to animals.

"On account of the rapid growth of the cattle-raising business in the United States, the demand for foreign hides does not keep pace with the increase in our leather manufactures. In 1810 one-third of all the hides used in the United States came from South America. In 1875 over eight million hides, foreign and domestic, were tanned in the United States.

Besides these articles which we have just been considering, such as hides, skins, meat, tallow, soap, glue, and bones, whose annual export value amounts to a hundred and fifty million dollars, is the trade in hoofs, hair, and horns, which, after disposition has been made of the meat, tallow, and hide (each having certain functions to perform), are saved for their several purposes. The short hair of cattle is used as an ingredient for mortar; the long hair of tails is used in the manufacture of hair-cloth, also for sieves, strings for fiddle-bows, &c.; while the shorter qualities are prepared for curling for stuffing mattresses, sofas," &c.

The horn is adapted to various mechanical and domestic purposes, and the demand is on the increase. Occasionally there is a scarcity of horns in the market. A great many horns and hoofs of cattle used in this country come from South America, Southern Africa, and Russia; but the horn button is not made of horn, but of the hoofs of horned cattle.

Recently devised methods render the horn soft and elastic like whalebone. Not only horn buttons are made of hoofs but many of the ornaments worn by the ladies upon their persons and dress. Cattle hoofs sell at the present time for fifty dollars a ton. The refuse bones and meat and the entrails, after the extraction of the tallow by a steaming process, together with the blood of all animals, are sold to the manufacturers of fertilizers. We learn that the firm of Bowker & Co., manufacturers of the Stockbridge Manures, pay forty thousand dollars annually for these refuse materials at the Brighton abattoir, which comprise but a small part of what they use, very much being obtained from Chicago.

CHEESE.

Of the products derived from cattle-husbandry, butter and cheese are attracting much attention at the present time.

There has been no industry among the varied enterprises of the country, excepting, perhaps, the petroleum trade, which has developed more rapidly than the manufacture of cheese.

Previous to 1870, cheese-factories had not long been established (the first one was established in 1851), and had not come into general use; but they were quickly adopted

because of their economy, and because a better and more uniform quality of cheese could be made than by the old. process. The production of the article increased so rapidly, that it became a problem of much importance where it would find a market; but this problem was soon solved by the demand from Europe, which, from seven million pounds (the amount of the exportation in 1870), increased to sixty-six million pounds in 1872, and in 1874 reached a hundred million pounds, — almost as much as was manufactured in the entire country in 1850.

The Europeans use cheese as an article of necessity; while the Americans use it as a luxury, or as a relish. A piece of cheese the size of a cubic inch will satisfy the average American stomach, while your European customer will eat as much as half a pound at a single sitting. Considering the greater amount of nutriment in a pound of cheese than in a pound of beefsteak, perhaps it may follow that John Bull has more wisdom or economy than Jonathan. I saw it stated recently, that the English consumption of cheese annually was about ten pounds *per capita*, while X. A. Willard puts it at sixteen pounds per head, and that, if a like proportion was consumed in the United States, it would require an annual production of seven hundred and fifty million pounds to supply the home demand, instead of about a hundred million pounds, which is now consumed, — a quantity that it would take some years to reach, even with the rapid increase of production that has characterized the past ten years.

BUTTER.

A writer in one of our leading agricultural journals, under date of July 5, 1879, says, "The prices of butter are lower in this market (meaning Boston) than at any time during the last twenty years. Dairymen are complaining that prices are lower than the cost of production; and the future prospect is far from encouraging. The production has increased so rapidly, that at no time within fifteen years has the market been so overstocked with butter and cheese as to-day. The shipment of butter to Europe has been on so extensive a scale, and such has been the competition with the butter of other countries in the British market, that prices have fallen so low, that thousands of the lower classes have been

enabled to enjoy what has been heretofore a luxury almost beyond their reach."

In an article of more recent date, the same writer says of the present price of butter, "that it is the highest ever known in this country." This remark is true upon the gold basis. In the short space of three months we have witnessed an unprecedented rise of dairy products. In four weeks, cheese advanced in price from a hundred to a hundred and twenty-five per cent.

The price of butter did not advance so quickly, or as much, as the price of cheese, but has advanced in the course of two months some sixty per cent.

The Boston Produce Exchange and the New-York Produce Exchange, both of which are official reports of the markets in their respective cities, say that the rise in price of these products has been unprecedented in the memory of the oldest dealer in the trade.

The New-York report says, concerning this rapid advance, "that it cannot be wholly accounted for, but that there are some reasons for it," naming the following: "The exports since the 1st of January have been twice as large as for the same time last year, and the consumption, both East and West, has considerably increased, while the make has been considerably curtailed during the dry weather of autumn." There are, it says, no large stocks held in this vicinity, so far as we can learn; and the indications are, that higher prices will continue to rule for the remainder of the year. And this is the encouraging feature to dairymen all over the country, who were, in consequence of the continued low prices for all dairy products, becoming despondent and discouraged. Goods brought in market less than their cost of manufacture; and, if continued at the same rate, many would be obliged to give up the business.

A large share of the receipts of butter in the Boston market comes from the West. It is but a short time since the butter-makers of New England held the leading position as to reputation and prices; but to-day the sceptre has departed. The product of the Western creameries commands more in the market than the Eastern dairy-make. At the International Dairy Fair held in New-York City a year since, the State of Iowa won the highest laurels for butter exhibit. It

is too true, brother-farmers of New England, that unless we adopt the improvements of the day, and look carefully after our interests, we shall be left entirely in the background as to quality of the product and to profit. With the use of refrigerating cars, and the advantage which they have over us as to railroad rates, they are enabled to lay down their product in the Eastern market in better condition than we can, and in direct competition with our own.

Advantage, I say, as to railroad-rates; for I learn that it is the fact, that, in some instances, butter is transported for twenty-five per cent less rates the distance of a thousand miles than for two or three hundred miles.

This matter of railroad-freights on through lines, acting against the interest of the farmers of the East, is worthy of our consideration. In very many cases, towns and individuals have rendered large pecuniary assistance for the purpose of constructing these roads, with the practical result to make the Eastern farmers' produce of less value than if there were no railroads. The farmer in Illinois is able to lay down his produce in Boston market at the same cost for transportation as the farmer in Franklin County, or less. Instances can be furnished without number where the low rates of through freight operate in this way.

But why is it that creamery butter brings a better price? We are told that it is because of its uniformity in quality. The butter is made from day to day, from week to week, under the same conditions, and always free from any thing that would impart unpleasant flavors. Milk set in a farmer's kitchen, or in any place where it will absorb odors from cooking vegetables, from tobacco-smoke, or from clothing fully charged with the odor of the stable, cannot make butter free from unpleasant flavors.

We complain of low prices received, when we ourselves are to blame. The flavor of the butter is affected by the feed and care of the cow. We lay the blame at the door of the dairy-woman, when he who feeds and cares for the cow is responsible.

We are repeatedly told that there is no danger of overstocking the market with a prime article; that the supply of first-class butter is less than the demand. The consumer is ready and willing to pay an extra price for that which suits

him, but finds fault if it is not up to the standard every time; and the dealer who supplies him, and to whom you send your product, does not feel very amiable when one of his best customers returns that sent him as unsatisfactory.

It is said that only five per cent of the butter which goes into market is strictly prime. Ninety-five per cent of it consists of all grades down to what is called "grease." I have seen it stated that last year there were forty thousand pounds of butter sold in one of our Western cities for soap-grease.

The proportion of butter not fit for the table, and hardly for cooking, is very large; and it is said that one-third of the value of all the butter made in the United States is lost by deficiency in quality. A waste of from forty to sixty per cent of the gross returns is a loss which no business can endure.

Of the different modes of setting, skimming, scalding, or churning, or whatever may be the character of the method, we shall not pretend to say which is best; but certain things are requisite in order to obtain good butter. First, good cows; second, good feed (good sweet early-cut hay and corn-meal with either carrots or sugar-beets stand first in the list of proper food); third, the utmost care and neatness in every manipulation, from the cleanliness of the cow and milking, to the marketing, and skill to put up in an attractive form and an attractive package. If the producer is not able to attend to these matters, the business of butter-making may as well be given up, for it will not pay.

The exportation of butter and cheese has increased so rapidly within the last few years as to alarm British producers. The superiority of American cheese is an admitted fact; and the papers upon dairy subjects which have recently appeared in the journal of the British Agricultural Society have urged upon the British manufacturers greater care as the only means by which they can retain their hold upon the home market. One of the English papers says, "It is sad to find that we are allowing the trade to gradually slip into the hands of the Americans, and that, while they are year by year increasing the quantity of their manufacture, and improving its quality, we are absolutely falling behind."

About a year since, in speaking upon the prospective

demand for dairy products, we remarked that considerable signs of discouragement were manifested on the part of producers of dairy products, because of the depressed condition of the market; but we expressed the belief that the low prices then ruling would induce a greater consumption both at home and abroad, which would result in raising the prices.

It seems to have proved true as then stated, and no doubt but in the future prices will fluctuate, consequent upon a variety of causes. But it seems also equally true that the demand which will be made upon this country, both by consumers at home and abroad, for our butter and cheese, is without limit.

The high reputation which American cheese has abroad will lead to an increased foreign demand.

In 1878 the production of butter and cheese in this country increased thirty-three per cent. The annual production of cheese is now estimated at three hundred and fifty million pounds, and of butter at a billion five hundred million pounds, and the value of both at three hundred and fifty million dollars, — one-seventh more than the hay-crop, one-third more than the cotton-crop, and only one-fifth less than the corn-crop. There are thirteen million cows in the United States; which is over six times the number of those in Great Britain, and more than twice the number of those in France.

The farmers of Franklin County are very much interested in the prosecution of this industry which we have been considering. No small part of our farming operations consists in the raising of neat-stock for sale, and the manufacture of dairy products. We are sorry to find, that, in consequence of the introduction of the smaller breeds, the number of our steers and oxen, for which Little Franklin has been so justly celebrated, is decreasing; but we have reason to boast of our butter product. It is gratifying to know that we manufacture for sale out of the county annually, besides what is used for home consumption, an amount not less than a million pounds, which would load a train of fifty cars of ten tons each, which, at an average price of twenty cents per pound, would amount to the sum of two hundred thousand dollars; and, if the quality could be so improved as to add to its value five cents per pound, the increase would amount to the sum of fifty thousand dollars. We hope such may be

the result of this meeting of the State Board of Agriculture, and the attendant State butter-show.

Thus, Mr. President and gentlemen, we have presented a compilation of facts showing the great importance of cattle-husbandry, and the exportation of its products, to ourselves and the country. We have reason to congratulate ourselves that such a market for our productions has been opened to us. The English markets are brought to the doors of the American farmer. We fed the Old World last year to the extent of over two hundred and fifty million dollars.

It is said that the United States is capable of producing a value of two billion dollars annually, in animals, in milk, flesh, labor, and wool.

The supply may be large; but the demand will be always equal to the supply. Careful study is needed on our part, in order to produce at the lowest possible cost, and at the same time not impoverish our soil.

In all markets the best productions pay the best profit. Cato, upon being asked what was the best system of farming, replied, "To graze well," having in view the connection between the feeding of stock and the production of manure.

Exercise your thoughts, in your labors, in the husbandry of neat-stock, in the manufacture and commerce of its products, and in maintaining the fertility of your farms.

The CHAIRMAN. Before our friend Slade reads his paper, there will be, as announced on the programme, and as has been customary at these meetings, an opportunity for discussion. Perhaps there is not so much occasion for discussion after the very full and able paper to which we have listened, as there might be under other circumstances, because it has dealt mainly with facts, and facts cannot be disputed. But we will spend a few moments, if you please, upon any subject germane to the essay, and, if any questions arise in the mind of any man as to the facts, Mr. Smith will stand up and answer them.

Mr. FLINT. I would like to allude as briefly as possible to the matter of contagious diseases, to which Mr. Smith referred, and the importance of guarding ourselves against them. That is a matter which seriously affects the cattle-trade of the whole country. You know that the disease

called pleuro-pneumonia, the most dangerous and most terrible of all our cattle-diseases, was stamped out absolutely in this State quite a number of years ago; but it still exists in this country, and, while it exists, it is a standing menace, not only to the cattle-owners of our own State, but to the great cattle-interests of the whole country. It exists just now, in at least five different States and in the District of Columbia. I believe there is no doubt that it exists in New York, New Jersey, in portions of Pennsylvania, in Delaware, in Maryland, and in the District of Columbia.

Now, while I wish to bring this matter up, I do not wish to bring it up to create any discussion, or cause any loss of time; but I wish every farmer to realize the fact, that unless we take steps, unless Congress take steps, to stamp it out absolutely, we are going to have the same trouble in this country which they have had in England for the last thirty years. England is paying something like two millions of pounds a year (ten millions of dollars) in a vain struggle against contagious diseases, of which pleuro-pneumonia is the worst. It is the worst, because it is the most insidious, because the period of incubation is so long. It is worse than the rinderpest, or cattle-plague, — a thousand times more to be feared by us, — because the period of incubation is so long. The period of incubation of the rinderpest, or cattle-plague, of the East, is not more than six days at the outside; so that, if an animal is exposed to that disease in Liverpool, and is shipped at once to this country, she must be dead, in ninety-five or ninety-nine cases out of a hundred, inevitably, before she can arrive in this country. But it is not so with the pleuro-pneumonia. An animal may be exposed to the pleuro-pneumonia to-day, and no mortal living can tell under forty days at least, and from that to eighty or ninety days, whether she is going to have the pleuro-pneumonia or not. Our experience in this State shows, that, of all the animals that are exposed to that disease, twenty-five per cent will take it and die. Another twenty-five per cent will take it, and just graze through; but the effects of the disease will never leave the system. There will be a large encysted mass or a diseased portion of the lung; and whenever that animal is killed, no matter whether it is five or ten years hence, that great mass of putrid corruption will be found there. An-

other twenty-five per cent will have it very lightly, and apparently recover. Another twenty-five per cent may escape entirely. But our experience here and the experience in England has shown that it is the most dangerous of all contagious diseases, because the most insidious.

But what I want to say is this, Congress can stamp it out now. No State where it now exists will be likely to stamp it out. You can hardly expect the States where it exists to take the steps we took fifteen or twenty years ago. If they would take them, they would get rid of it; but they would be obliged to spend a great deal of money, and it would require a great deal of labor and a great deal of time. It might be done; but there is no probability that it will be. If Congress would make an appropriation of one or two millions, I believe, and the best veterinary surgeons of this country believe and know, that it can be entirely and absolutely stamped out. That would be the very best possible investment that Congress could make, — to stamp out that terrible disease throughout this country.

Now, the practical point is just this. I hope the State Legislature will memorialize Congress to make an appropriation adequate to stamp out this disease. If England, when the disease appeared on her shores, had taken the course which we took in 1859, 1860, and 1861, she would not have that disease to-day. Now she is paying vast sums of money every year in a vain struggle to keep it down. She cannot expect to get rid of it now: it is probably fixed there for all time. And let it go on in this country five or ten years more, and do you suppose that a hundred millions would eradicate it? It would be utterly impossible. If we neglect it now, when it can be extirpated, we shall have it fixed upon us just as England has it to-day.

Now, if the Legislature of Massachusetts would take that course, if they would petition Congress to take measures to extirpate this disease, they would be backed up by every cattle-owner in the West. The time is coming when they must wake up to the danger. If it is neglected, we shall be, ten years hence, just where England is to-day, — so far as the cattle-interest of this country is concerned. If we act now with promptness, if Congress act, it would be sustained by Massachusetts and by the West. One thing is now practica-

ble; and it is within the power of Congress, and no other power that I know of, to get rid of the disease. People who have seen nothing of it cannot realize the danger and risk to which cattle-owners will be subjected if it is allowed to spread. We shall have it here again inevitably. It cannot long exist in other States without being a constant menace to us. I have been astonished that we have not had it before now. Unless the greatest vigilance is exercised, I do not believe it is possible for us to go over another year without an invasion of that terrible disease.

Mr. Willis P. Hazard (of West Chester, Penn.). I desire to second the suggestion of Mr. Flint. It is, as he says, a national matter. Allusion has been made to Pennsylvania; and I desire to say that our Legislature, at its last session, gave authority to the Governor, with the State Board of Agriculture, of which the Governor is president, to stamp out the disease; and at the present time, the secretary of the State Board, whenever he is notified (and the law makes it the duty of cattle-owners to notify him) of the presence of the disease in any place, immediately sends a veterinary surgeon there, who makes an examination of the cattle, and, if he finds a decided case of pleuro-pneumonia, the cattle are killed, and the State pays the owner for them. But no matter how vigilant the State of Pennsylvania may be, or how earnestly it may desire to stamp out this disease, it is truly a national matter. Massachusetts is just as likely to be attacked by the disease as Pennsylvania is, simply from the fact that we raise a great many good cattle, and they are sold all over the United States. If I have a herd of Jersey cattle, and a man sends to me from Georgia, or any other State, for one of them, I ship him one, not knowing that it has the disease, and, on its arrival, the disease may be developed. In that way, the disease is distributed all over the country, and no matter how diligently one State may seek to stamp it out, it is a national matter, as Mr. Flint has suggested.

Hon. E. H. Hyde (of Stafford, Conn.). I cannot resist the temptation to indorse the sentiment expressed by Mr. Flint. We are all in deep anxiety in regard to this disease, and, as he has remarked, it is certain to make its appearance among us sooner or later. We in Connecticut, bordering on the line of New York, have been constantly and carefully

on the watch to prevent the spread of the disease in our own State. It exists all along the border of our State, in Putnam County, New York. We have had, as you know, a few cases. We have been peculiarly fortunate, perhaps more fortunate than any State that has been exposed in a like manner. During the last season we were exposed to the disease from a herd at Waterville, N.Y. We immediately took the most vigilant measures to protect our people against its ravages. We used every means the State gave us; but our power was limited. The president of the Massachusetts Agricultural College has intimated what a State may do, what Massachusetts has done. That is not Connecticut. Connecticut has empowered her Commissioners simply to quarantine, but has not appropriated a dollar for the protection or the slaughter of cattle, and, without that, the disease can never be stamped out.

But I digress. I will go back to Waterville. In that herd, the fatality was about what has been intimated will be the result everywhere, somewhere from twenty-five to fifty per cent of loss. Nine out of that herd died. The owner, finding himself with eleven or twelve more animals, followed the course that most of us are more or less inclined to do in such circumstances. One Saturday night, he shipped them to New York, that they might land there on Sunday, giving him that day to spread them broadcast. Our Commissioner followed them there, and, with the aid of the New-York Commissioners, they were immediately arrested, condemned, and slaughtered. By that means, with the enforcement of a strict quarantine, we avoided any further trouble from that herd.

Then we had two other herds just upon the line of the State. In one case, the line between Connecticut and New York runs diagonally through the farm of the gentleman who owned the cattle. It would have been very easy to have carried the contagion from one State to the other without a united Commission. In the first instance to which I have referred, the disease was communicated by a cow bought by Curtis Judson, keeper of the Gramercy Park Hotel, New York, and sent to Waterville.

Thus much as to the danger of the spread of the disease; and the necessity of some action, and none other than the

one that has been referred to will be efficient. I most heartily indorse the sentiment expressed by Mr. Flint, and hope every gentleman will unite in asking the National Legislature to aid us in this great and important work.

The CHAIRMAN. Gentlemen, you have heard the interesting remarks which have been made, and have matter for intellectual digestion, which you can take and store away until after we have heard Mr. Slade's essay on his experience on the farm. I have the pleasure of introducing Mr. AVERY P. SLADE, a member of the Board of Agriculture, and a practical farmer.

MY FARMING EXPERIENCE, AND SOME OF THE LESSONS IT HAS TAUGHT ME.

BY AVERY P. SLADE.

In 1844 I came into possession of a farm containing forty acres of land. Ten acres, being wet, stony, and sterile, had never been ploughed. The balance had been ploughed, planted, and literally skinned by constant cropping, for a period of seventy years; while all the manure or fertilizing material that was ever returned to the soil was dropped by the cattle as they grazed in the pastures in summer, or around the stacks where they received their scanty rations in winter.

The farm has an easterly slope. The most of the soil lies on a clay bottom, and was originally well adapted to grass. The original proprietor of the farm took possession in 1732. He was a ship-carpenter, and worked at his trade. He, however, built a house and barn. The work on the farm was done by ten slaves. They dug stones, and built about two miles of stone wall. They also set an apple-orchard of about two hundred trees, the most of which was natural fruit, and in due time made a hundred barrels of cider per annum, all of which was supposed to have been drunk on the premises.

These constituted the bulk of the improvements during the lifetime of the first owner. In 1760 he died, the slaves were freed, and improvements ceased. The farm was inherited by a son, who followed in the footsteps of his illustrious ancestor. He ploughed and planted without manure, and yet, I am told, raised fair crops, — crops rather above the

average in the neighborhood. This owner died in 1820, leaving the farm to five daughters, who were forthwith assigned eight acres each. Then commenced the most reckless and abominable system of tillage that ever disgraced a farming community. These girls were dependent for their support entirely on the income from their inheritance. Therefore each rented or leased her share to the highest bidder during the term of her unmarried life. Practically they were not in favor of early marriages, consequently some of the leases had a long time to run. No stock was kept on the farm: every foot of arable land was put under cultivation; and this continued for a long series of years, until the crops were not worth harvesting. Every ounce of plant-food had been extracted from the soil, and even the weeds refused to grow, although the ground was literally filled with seed.

The walls were down, so that the cattle could roam from field to field without obstruction; and a flourishing hedgerow, from six to eight feet wide, was a pretty sure indication of the neighborhood of the old foundations. The small stones not suitable for building had never been removed from the land, but from time to time had been thrown into heaps containing about one ton each; and around these bushes had been encouraged to grow as a sort of guide to the scythe and the ploughman. The old barn being unoccupied, and having survived its usefulness, succumbed to the blasts, and fell to the ground. The old house, that had faced the storms of more than one hundred winters, had never been repaired, if we except the roof, which was comparatively tight. Pigeons had free access to the attics; and the swallows had their holes in the eaves.

Such was the condition of Weeping Elm Farm in 1844, when it came into my possession. And when I look back to that time, and take into account the impoverished condition of the soil, the want of suitable buildings, the limited state of my finances, which precluded the possibility of making the needed improvements, and, above all, my total ignorance of almost all the principles that underlie successful agriculture, I am surprised at the enthusiasm with which I commenced farming on my own hook.

And what is still more remarkable, when viewed from my present stand-point, is, that I should continue to work early

and late, year after year, while the gross income of the farm barely sufficed to pay the grocery-bill for a family of three. During the first year I built a barn, repaired the house, rebuilt about two hundred rods of stone wall, and drew off as many tons of small stones. I stocked the farm with a horse and cow, and hired a boy for seven months, to whom I paid four dollars per month. I sold nothing the first year from the farm, but was complimented by my neighbors, who assured me that I had increased its value five hundred dollars. By a prudent husbandry of my manurial resources, I was enabled the following year to cut several tons of hay; and the net profit from my potato-crop was equal to that of my neighbors, to say the least, as it was that year that the rot first made its appearance, and all went by the board. I do not intend to weary you with a detailed account of my successes and failures from year to year; but I will simply say that I went on building wall, removing rock and small stones, under-draining, setting some fruit and ornamental trees, buying manure, and making what I could with my stock (which gradually increased), and raising such crops as was the custom of the neighborhood, and with about an average success, for a period of eighteen years. Allow me to say here that the money I had earned outside of the farm up to this time exceeded the amount I had expended for labor about $1,200.

In the spring of the year 1862 I purchased twelve acres of land, for which I paid $1,067, paying $200 cash, and giving my note for the balance. With this commenced a new era in my farming career. I had chosen farming for my vocation. I rather liked the business; but for a long time I had been thoroughly disgusted and disappointed with its financial results. People in other business had luxuries which I could not afford. Even an ordinary mechanic would net more money at the end of the year than it was possible for me to do with a forty-acre farm. It was the custom to raise hay, oats, corn, rye, and potatoes, the latter finding a good market in Fall River at remunerative prices, was chiefly relied on as our money-crop. About this time, a friend from the West, who had been absent for several years, made me a visit. I took him over the farm, showed him the improvements I had made, of which I confess I was rather proud, and asked him what he had to say. He replied, "I think

well of your improvements; but how much money have you made?" This question I was neither prepared nor inclined to answer. But, without waiting for an answer, he added, "You will never make any money until you do *less* work with your *hands*, and *more* with your *brains*," and assured me that it was a poor farm that would not support one gentleman. Here the conversation ended, but not so the impression it made on my mind.

This brief interview turned the whole current of my thoughts into a new channel, and resulted in changing the whole programme of my farming operations. I was not long in deciding that I would do *something;* but what that something was to be I had not the remotest idea, only it should be something different from what I had been doing, and something that had some money in it. The idea of being a gentleman-farmer, of using one's brains instead of his hands, and of making some money at that, struck me as being a decided improvement on the old style of farming, while at the same time it acted as a constant and powerful stimulant in all my endeavors to substitute brain-work for hand-labor, and increase my income by the operation. But then came the all-important questions, What shall I do? and how shall it be done? I pondered these questions for anxious days and sleepless nights, and came to the conclusion that I must make a specialty of some particular crop. This being settled, the next point to be determined was, what that crop should be. This I found was no easy matter to decide in my own mind. A variety of schemes presented themselves, were examined and rejected.

My first thought was, that I would give my attention to the growing of onion-seed. This project was backed up by the fact that I remembered having seen a man drive up to Quincy Market in an open buggy, and take out three hundred pounds of onion-seed for which he received twelve hundred dollars. It occurred to me that he was a gentleman-farmer, and was evidently making money. But from what I learned about this business on inquiry, together with the fact that at that time I did not own a buggy, I was induced to abandon the project. Then I thought of going into hops, sage, and tobacco, and many other things, while I was met by what seemed insuperable objections lying in the way of

each. Another scheme which commended itself to my judgment very strongly, and one which I have had reason to regret that I did not try on a small scale, was the setting out of osier or basket-willows. I had about six acres of land well adapted to their growth; and, as it has proved, it would have been a profitable enterprise. This subject of making choice of a crop as a specialty engaged my thoughts far into the spring, and yet I was undecided what to do. One thing was firmly fixed in my mind, and that was to make a change. I was determined to get out of the ruts, if I broke the wheel in the attempt. About this time I received a catalogue from a nurseryman; and the result was, that I sent him an order for four hundred grape-vines, two hundred currant-bushes, and two thousand strawberry-plants, hoping, by selecting a variety, I might be able to discover which was best adapted to my soil. Up to this time I had been regarded as a hard-working, level-headed farmer, thoroughly orthodox in the practice of deep-ploughing, manuring in the hill, and of raising on the farm, so far as was possible, every article of consumption that was supposed to be needed in a farmer's family. But now it was said that a strange freak had come over me; and the predictions of my neighbors were any thing but flattering. It is with pleasure, however, that I remember, that, in what was regarded as my folly, I had the sympathies of my friends. While some thought that I might possibly succeed in raising these crops (I never could sell them, for they were not in demand in the market), others blamed me for undertaking to do something of which I was totally ignorant. Here I would say that ignorance should never deter a farmer from doing what is best for him to do. Every one, if he have any brains, should be able to do what others have done, and, if he is deficient in brains, any other business will be better suited to his capacity than farming. One man came to me in a very friendly spirit, and remonstrated with me against raising strawberries in particular. How do you expect to get them picked? you say they begin to ripen about the middle of June, the busiest month in the year: have you thought of that?

These and many other equally strong objections were urged and met by suggesting that sufficient unto the day is the evil thereof. In the fall I manured my currants, covered

up my strawberries, and cut my grape-vines back to two eyes. The winter had its hopes, though it was not without its anxieties. In the following spring I found that my strawberry-plants had wintered well; and a little later I discovered that about one-third of my grape-vines were dead. As I intimated in the beginning of this paper that I should make known some of the lessons which my farming experience had taught me, I will here state what I learned at this time. Lesson 1st, Never purchase a second-rate tree, shrub, vine, or seed of any kind, at any price, however low, when you can get a first-rate article at a fair price. The importance of this advice cannot well be over-estimated; and I would recommend that every young farmer's wife work it in worsted, and place it in a conspicuous place, and, if her husband follows the advice, one important step in the right direction will have been taken. I had purchased low-priced grape-vines, and, what is unusual even in these times, I got just what I purchased. I subsequently learned, that they had been forced into existence in a greenhouse by bottom heat, and were as ill prepared to stand the winter without protection as would be a January chicken hatched in a modern incubator. My strawberry enterprise proved a success. From the two thousand plants, I sold two thousand boxes, which amounted to six hundred dollars. Had I discovered a gold-mine on my farm, I should not have felt more elated than I did at this unexpected success. This stroke of good-fortune settled every thing in my own mind, and gave me an amount of self-reliance which I have never been without up to this time. It was Napoleon who said that it required greater generalship to take care of a victory than to manage a defeat; and I think this holds true outside of military tactics, and applies to the every-day affairs of life. Had my first experiment proved a failure, I should undoubtedly have tried again, and till I succeeded. But it was a success: I had gained a victory, and, had I made the most of it, one great blunder of my life would have been avoided. I had thousands of plants, plenty of land, and one year's experience, and but very little competition; and still I neglected to enlarge my beds to any great extent. There was no earthly reason why I should not have raised four thousand dollars' worth of strawberries in 1865, instead of a thousand dollars' worth.

That I should neglect so good an opportunity is a matter which I have never been fully able to account for. But the receipt of six hundred dollars all at one time for what grew on a third of an acre most paralyzed my energies, and made my senses reel; and then my neighbors, who took a lively interest in my affairs about this time, decided that six hundred dollars was about as much money as was safe for a man to have at one time.

Since my new departure, my farming has been pleasant, and somewhat remunerative; and the substitution of brain-work for what is called bone-labor has been attended with very satisfactory results. I raise strawberries, currants, grapes, and asparagus, and rely chiefly on these crops for my income. During the last year they amounted to a trifle over twenty-seven hundred dollars, netting perhaps seventeen hundred dollars.

The above is stated, not as any thing to boast of, or as being very remarkable; but I respectfully submit that it is an improvement on the old style of farming.

I usually cut about twenty-five tons of hay, and frequently raise corn, rye, and potatoes as a means of preparing the land for what I regard as a more profitable crop.

My experience has taught me, that although weeds can be raised easier, and will stand more neglect, than any other crop, they are the most unprofitable crop that a farmer can grow, whether separately, or in connection with other crops. Cleanliness is a virtue which ranks next to the highest in the code of morals, and clean culture is its exact counterpart in the cultivation of the soil. Weeds are the little vices which beset plant-life, and check its growth, and obstruct the development of the seed, the fruit, and the flower. I know that it is said that a weed is simply a plant in the wrong place. That may or may not be something in its favor. I am not a convert to the doctrine recently advanced, — that a few weeds may be suffered to grow, as they return to the soil nearly all they take from it. Weeds should be exterminated: they should be destroyed, not only from policy, but from principle.

How to accomplish this in the most thorough and economical manner, I think I have learned from many years' experience. Any manure suspected of containing weed-seed should

be forked over several weeks before using, and thrown into heaps; and the fermentation which follows will destroy a large portion of the seed.

In all hoed crops, be sure to plant in such a way that every hill, vine, or plant can be reached with the cultivator; and my practice is, where I grow small-fruits, to leave a sufficient margin on the ends of the rows for the horse to come round without injury to the plants. Farmers often make a great mistake in allowing weeds to get a good start before putting in the cultivator or the hoe. In raising onions, or, in fact, any crop where clean culture is important, it will cost less to hoe it once in eight days than it will to hoe it once in fifteen days. This rule I have strictly adhered to ever since I commenced farming for profit.

The making of manure and its application, and the use of fertilizers, is a subject closely connected with successful farming. Immense sums are annually expended for fertilizers, without any certainty of a profitable result. After all the light which science has shed upon this important subject, the average farmer still remains in a state of glorious uncertainty as to the possibilities resulting from the use of fertilizers; and even the *perfect plant-food manures* so ingeniously elaborated by Professor Stockbridge have been known to differ from the promised result. What fertilizer would you advise me to use on this crop or that? is a question which has become stereotyped among farmers. I regard this as a hopeful sign; for, when a man begins to ask questions, it shows that the conceit has been taken out of him, and he is ready to learn.

Now, here is where a little brain-work is called into requisition. Before a physician can treat a patient successfully, he must first learn, by symptoms or otherwise, the nature of his disease. So a farmer must first learn, by observation or experiment, what particular element of plant-food his soil is deficient in, before he can determine which is the proper fertilizer for him to apply for a given crop. This is something that a farmer must learn himself, and then govern himself accordingly. I received a letter from an old acquaintance some years ago, saying he was intending to plant six acres of potatoes, but was in doubt as to the fertilizer he should use.

He used to be an inveterate whist-player, and was always governed by one rule, viz., when in "doubt, always play a trump." I replied to him, without giving the subject serious thought, by saying, when in doubt, always use Rectified Peruvian Guano. He took the advice; and, as his land contained a surplus of potash, he has raised several splendid crops. When stable-manure is used, which is supposed to contain all the elements of plant-food, for any given crop, the element predominating in the crop should be used or supplied in excess. For instance, if I wish to grow strawberries or potatoes, both of which are potash plants as we say, or both draw a large amount of potash from the soil, I would spread my manure, and then, by using ashes or the muriate of potash, I would supply a large amount of such food as the plant was eager to get.

This has been my practice, to some extent, for the last ten years, and has rarely ever failed in giving satisfactory results. In regard to the application of stable-manure to hoed crops, my experience has taught me, that it should be kept near the surface. I know that we are told that plant-roots penetrate the soil at great depth, and, however deep you may put your manure, the roots will be sure to find it.

That is very true; but it makes a vast difference to the growth of a plant, whether its roots feed three inches or six inches below the surface: the lower the temperature, and the less the atmospheric influence, the farther below the surface you get. Top-dressing grassland, either with solid manure or with special fertilizers, I hold to be both wasteful and extravagant, and is practised only in rare instances where farming is conducted for profit. The application of liquid manure to grassland, where it is not attended with too much expense, may be practised with good results. The lesson, above all others in importance, taught me by experience, relates to the time of cutting grass, and how to cure it. When we consider the enormous money-value placed upon the hay-crop, and to what extent its intrinsic value is affected by the manner in which it is cured, we feel that the importance of this subject cannot be well overrated.

It is not the farmer alone who has a deep interest in this matter, but every person in the country who keeps a cow or a horse. And one of the strangest things connected with the

whole matter is, that farmers are so slow to learn and practise what is so plainly for their own interest. I know a farmer, — yes, I know scores of them, — who, guided by the usages of their ancestors, begin to mow on the Monday after the 4th of July, as though, on the morning of that day, by divine appointment, grass came to maturity, and should be cut. If they would appoint a day when they would pick their pease, or their cucumbers, or even their fruits, and adhere to it, they might possibly be made to see the absurdity of such a rule. The most careless observer must have noticed, that the time of ripening of vegetation varies with the season from ten to fifteen days: hence the idea of naming a particular day as being the right time to begin to mow is simply ridiculous. The right time is when the stalks contain the greatest amount of nutritious matter; and that, I think, is indicated by the blossom. When a field shows a greater amount of blooms than it will at any other time, it should be mowed immediately. The point to be aimed at in making hay should be to preserve as much of the gum, sugar, and starch in the stalk and leaf, as is possible. Now, in order to secure this end, the stalk should be entirely and absolutely free from external moisture; and, when this condition is attained, it requires but very little sun to fit it for the barn. If one wishes to ascertain how little sun is required to make hay, let him take a grass-hook, and go into a field in the middle of a bright day, and cut some grass, lay it even as you would rye; cut enough to make a bundle ten inches or more in diameter; lay it on a rock, if convenient, and let it lay one hour exposed to the sun; then, for convenience, put it on a piece of cloth about a yard long, and as wide as the grass is long; roll it up solid, and then, with a piece of marline, seize it hard, so it will be air-tight; then you will have a bundle of hay containing nearly all the nutritious matter that was in the grass when it was cut. A process on a large scale, involving these conditions, would enable us to feed grass in winter as well as in summer. The sudden atmospheric changes, however, to which we are liable, especially on the seacoast, renders it very difficult to give infallible rules for making hay. Even in a single day or hour, the temperature sometimes varies from the extreme dryness of a north-west wind to the humidity of a south-

easter, in which a fish would hardly perceive that he was out of his native element. Now, in the former ease, we make hay too mueh, and, in the latter, we do not make it at all. It is all important to put in hay in the middle of the day, when it is dry and hot; then it will come out bright and sweet. But if left out till four or five o'clock, or till a vapor begins to form in the atmosphere, I will warrant it to come out smoky every time. There is a meadow of seventeen acres adjoining my farm, which cuts annually about a ton and a half to the acre. The proprietor, an old gentleman, with his sons, used to mow it by hand. You will pardon me, if I briefly give you his method of making hay.

The meadow was carefully watched, and, when it was decided that the grass was done growing, the signal was given to commence. This time usually varied from one to two weeks after I had finished my haying. All of the first day and the morning of the second was spent in mowing till ten A.M., when all hands went to spreading swaths, which took them till noon. Then they were absent from the field about an hour and a half, and, when they returned, they would moderately proceed to grind their scythes, after which they reposed under a big ash-tree till four P.M., patiently waiting for the hay to make. They then began to rake and heap up what was mowed the day previous: this job was usually completed about eight P.M. The next day they would mow till ten A.M., and then spread the cocks, and, after dinner, the swaths, and then grind, and wait till four P.M. for the hay to make. At this time the gang was divided, — one went to raking and heaping up, and the other to drawing in, finishing about nine P.M. They all preferred the cool of the evening to the noonday heat, and managed their work accordingly. Now, it will be observed that all this hay was raked, heaped up, and drawn in, after the dew began to fall; and the result was, of course, smoky hay, containing but very little nourishment. That man used to buy hay of me for his cows in the spring; for he said they were like men, they wanted a change. Mr. John Johnson of Framingham, in a paper read before the Board, gave his method of making hay. He cuts his grass when in the blossom, begins to mow when the dew is off in the morning, and immediately after

dinner begins to rake and draw in, filling a bay holding several tons each day. Mr. Johnson stated that the hay put up in this way came out bright and sweet, and was of far more value than if it had been exposed to the sun longer. I had an opportunity to examine this hay in September, and found it substantially as Mr. Johnson stated.

Mr. Frank Bowditch of the same town, a very successful dairyman, and a close and careful observer, says that he manages to feed his cows on early cut hay through the year, and recognizes the same principle in curing it that we have enunciated.

One of the most important and costly lessons which my experience has taught me relates to the changing of seed, or of substituting new varieties of fruits or plants for old ones.

> "Be not the first by whom the new are tried,
> Nor yet the last to lay the old aside,"

is not only good poetry, but good advice; and, had I heeded it, several serious blunders of my life would have been avoided. Not but what new varieties are often superior to the old, and should take their places; yet the change should be made with great caution and on a small scale. Many new fruits originating west of the Hudson River, for instance, and which do well in their native soil, are nearly worthless when cultivated in Massachusetts; and others which are regarded with favor in the northern portions of this State are of little value in Bristol County. Plants, as well as domestic animals, before yielding their best results, must first become acclimated: hence the well-recognized fact that they always succeed best when the soil, culture, and climate into which they are transplanted, corresponds most nearly with that in which they had their origin.

I am often asked to recommend some particular crop as a specialty. To this I reply, Grow those crops which yield the greatest net profit, — the crop which, all things considered, has the most money in it. What that crop should be must depend on the soil, climate, and market facilities; and what these are, no one is supposed to know better than the farmer himself. There is not a particle of doubt but that many crops which are grown in New England at a mere nominal profit, year after year, might be superseded by others, with

great advantage to the grower. It is estimated that nearly one-half of the small-fruits consumed in New England are raised in the South and West. This is much to our discredit. We have a soil and climate suited to their growth; they are profitable crops to grow; and there is no good reason why we should not raise them in quantities sufficient for our own consumption.

The currant, for instance, requires, or flourishes best in, a cold, clayey soil, acres of which may be found lying idle in any town in this State; and yet Long Island is allowed to furnish Boston market with about one-half of the fruit of this kind that is sold there. The same may be said of grapes and cherries. Let us inquire, for a moment, into the details of growing, say a half-acre of currants, and note what the result is likely to be.

A piece of land fitted to produce a good crop of potatoes is in good condition to set to currants. Setting four feet by five, it will require about twelve hundred bushes, and they should cost at the nursery, say five dollars per hundred, or sixty dollars. During the first season, potatoes may be planted between the rows and between the bushes, without materially injuring their growth, or the yield of the potatoes. During the second year, beans may be planted between the rows, which, with what first grows, should nearly pay the original outlay. The third year they should produce a pound and a half to the bush, which, at six cents per pound, would amount to a hundred and eight dollars. After the bush has attained its growth, with good culture, a fair average yield would be about three pounds to the bush, which, at the above price, would amount to two hundred and sixteen dollars. The annual expense for labor and manure would not vary materially from that required on a half-acre of potatoes after they were planted. Now, do not understand me as recommending the growing of currants, or any other special crops; but the point I wish to make is simply this, raise such crops as will net the most money, whether they be currants, pop-corn, or pumpkins. Finally, gentlemen, my experience has convinced me that farming, with all its drawbacks, is about the best business that a young man can engage in; and he should not regard it as a great misfortune, if it fell to his lot to redeem and restore a worn-out

farm of New England. The worn-out and deserted farms of New England? — that expression, indeed, has a sad and sorrowful significance. Where are the young men whose strong arm should have redeemed, and restored to fertility, the impoverished acres of the old homestead? They have fled to the cities, making haste to be rich. He who shall devise effectual means of keeping farmers' sons at home should be regarded as a public benefactor. The farmer's boy exchanging home for city life, or taking a journey into a far country, is suggestive of the prodigal son, the sad history of whose folly has become a household word. I fancy that I can see the old man in his big arm-chair, with tears in his eyes, saying to his neighbors, "If I had only had this music and dancing in my house when I ought to have had it, my boy never would have gone away from home." It is only through mental and physical labor that a healthy development of mind and body can be attained. "By the sweat of thy brow shalt thou eat thy bread," was a beneficent penalty, the most lenient sentence that Almighty benignity could devise. To live without labor of some kind is a flagrant violation of a physical law, the consequences of which sooner or later must be met. The man whose energies are quickened by his necessities, and who depends for the comforts of life on success in business, acquires a certain discipline which is absolutely essential to the development of human character. He who, from day to day, earns his daily bread by honest labor, devoting a portion of his time to moral and intellectual culture, is in a plane of existence yielding more true happiness than he who occupies above or below him. This I consider the position held by the farmer.

There is no calling in life exempt from its trials, or that has not its reverses.

The merchant is haunted by protested notes and unpaid bills. The manufacturer finds a market glutted by overproduction, and can only see a profit in the shrewdest management and the closest economy; while his hopes and fears rise and fall with fluctuating prices.

The mechanic, for the sake of employment, allows his employer to fix the wages; doctors and lawyers live chiefly by the misfortunes of others; ministers claim that they do not get their pay till in the next world; while the honest,

intelligent industry of the farmer is speedily followed by its merited rewards.

The CHAIRMAN. Gentlemen, there will now be an opportunity for a full and free discussion of any of the subjects that have been brought up to-day. I will request Mr. Hadwen of Worcester to take the chair, who will, much better than I, develop the debating talent there is here.

Mr. HADWEN. I will merely say, in the opening, that I can verify the statements of our friend Slade in his essay; for I have had the pleasure of calling at his place, and saw with my own eyes his farming, which he has described to you. I can state that he has not overdrawn the picture, but has given you the facts in perhaps as concise a way as possible. He is certainly a good farmer, and has been quite successful in growing his specialties. He has evidently sought out the very best modes of cultivation; and his farm indicated, so far as I was able to observe, not only a farm where a gentleman could reside, but a farm which paid a good profit.

Mr. WARE (of Marblehead). There is one thought that has impressed itself upon my mind since this paper on farming has been presented to us, that seems to me one of very great importance. We are discussing from day to day the results of agriculture; and the question is often asked, "Does farming pay?" We are oftentimes told that the business of farming is laborious. We know it is; and we also know, that, for the last few years, the results of agriculture have not been satisfactory in a pecuniary point of view. But let me tell you, my friends, as the gentleman who presented that paper has said, that, after all, there is no better business than farming. I am ready to join hands with him, and say, that, in my opinion, there is no business to-day that offers better results than those of the farm, although that, as well as other branches of business, has suffered in a pecuniary point of view; or, in other words, we have not been able to make much money for the last few years. I would ask, What business has? What manufacturing business, what professional business, has returned the results that were anticipated?

Mr. WHEELER. While I was very much interested in the paper read by Mr. Slade, there was one idea advanced by him, to which, when it comes to be read over in Berkshire

and along the valley of the Housatonic, if I should not object, I should hardly stand justified before my constituents of the Housatonic Agricultural Society. If I understood him right, he said that the top-dressing of grassland, either with stable manure or commercial fertilizers, was not an economical operation.

Mr. TAFT. He referred to Bristol County, and not to Berkshire.

Mr. WHEELER. I did not understand him to make any distinction between different sections of the State; and I desire an opportunity to protest against the Board of Agriculture teaching that doctrine. We believe over there, along the valley of the Housatonic, that we cannot put our stable manure to better use than by fertilizing our grasslands with it. Our grass — either in the form of hay, or as pasturage — is our leading crop; and, as I said, the experience of our leading farmers is, that the best use they can put their manure to is to fertilize their grassland with it in the form of top-dressing.

Mr. WHITAKER. Wise judges say, with regard to this matter of top-dressing land, that it depends entirely upon what kind of land we are going to top-dress. That is the whole secret. If Mr. Slade and Mr. Wheeler would come together and compare notes, I have no doubt they would entirely agree. We quarrel half the time about things, simply because we do not get our propositions fairly stated. If Mr. Slade will state the kind of land that he would, or would not, top-dress, and Mr. Wheeler state the kind of land that he would top-dress, I think they would not disagree a single particle. There is some land which I would not make the attempt to top-dress, or, if I top-dressed it at all, I would do it the fall following the season when it was seeded down. If seeded down this fall, I would top-dress it next fall. I would even go farther than that: I might seed it down in August, and top-dress it in October. But one of the most ridiculous things I know of is to top-dress worn-out grassland. The best thing you can do with such land is to turn the old sod over, harrow it, put some fertilizer on it, and seed it down. When you have done that, you will have a crop large enough to pay the extra expense of ploughing, and a much better crop than if you attempted to top-dress the land,

because, if you did, you would surely fail. I have tried for several years to bring up what I call dry, sandy, gravelly loam, and I have never succeeded well with it. I have never got my money's worth back in putting it on that kind of land. If I had a stiff, clay soil, coldish land, or natural grass-land, I would top-dress it, and keep the grass in for twenty years, and never stir it with the plough. If you have had a dry season, and your grass is worn out or dried out, you will find that the best thing you can do is to plough it at once, even if you seed it down immediately.

Mr. J. T. Everett (of Princeton). My practice has agreed with that of the gentleman who has just sat down. Top-dressing on moist land, natural mowing, clay soil, is always the best, as I think: that has been my practice. But any land where corn will grow well, or crops of that kind, should be ploughed as Mr. Whitaker has stated, as it seems to me. It has always been my custom to top-dress only wet land, that does not need ploughing at all. Such land it may be profitable to top-dress about the time the gentleman has stated, — in October or the first of November.

Mr. Gray. Mr. Slade recommended the use of liquid manure. I would like to ask if there is any one here who has had experience, whether it is most economical to keep the two kinds separate, or to draw in an absorbent, and cart it all out as solid.

Mr. Whitaker. I think that drawing in absorbents and drawing them out again is about as foolish a business as a man can be engaged in. If you can think of any thing more ridiculous than drawing in a load of sand for the purpose of getting it wet with water, and then drawing it out again, I cannot. All that makes the liquid is water: the solid part is the fertilizing part. I cart them out at the same time together. I recollect one day when I was loading up a team, and was going to spread the manure on some grassland, the man who was working for me said, "If this had some sand in it, we could get it out, and spread it a great deal quicker." — "I know it," I said. "But look here! I heard you say something about whiskey the other day, and you said you liked it. Now, supposing I should put a teaspoonful of whiskey into a pint of water, how would you like it?" He said he wouldn't like it at all. "Well," I said, "that is just

like mixing sand with manure: you don't get any more manure by doing it."

In my barn-cellar I have a hollow place about in the centre, where the liquid portion of the manure leaches in. I can fill a barrel with that, and put a stick through it, and, although that is rather a primitive way of carrying it out, my man and I can carry out in that way four times as much as my horse can draw out in the same time if it is mixed with sand. Sand is about as heavy as any thing you can find: it is a great deal heavier than loam. If I were going to adulterate my manure with any thing of that kind, I would put in meadow-muck, but not until after that meadow-muck had laid in a pile one year, and been well frozen, and then well dried through one summer; and then, in the fall after that, I would take that muck, and put it in my barn, and let it absorb the liquid manure, because I think the fertilizing matter in the muck would be sufficient to pay for hauling it into the barn, and hauling it out. But there is very little fertilizing matter in sand. I prefer to draw it out in the way I have stated, even though the stuff drips over the tail-board. If I want to compost it, I compost it as I have said, and go over it with a harrow when I get it on the land.

I have tried carrying out this liquid manure, and distributing it on my own land, and will tell you something about it. I had seen it tried many times in Scotland, on Italian rye-grass and orchard-grass, which grow rapidly, and I determined to try it for myself. I had a piece of ground sown with Italian rye-grass and orchard-grass, for the purpose of experimenting with it. I mowed it for the first time last year. A year ago this spring, I sowed it with barley, which I cut for soiling; and then I took from that field another crop of grass, which was made into hay; and I cut some afterwards, which I fed green. This spring I commenced to take out this liquid manure. It was not very far, and I took it with my man, and, for experiment, we just dashed it on; and I cut that grass four times this year. It was, as I have said, orchard-grass and Italian rye-grass. I cut it the first time about the last of May, and I cut it three times afterwards. I would not apply the liquid when the ground is dry. If you put it on then, you will be very likely to lose the effect. Put it on either when it is raining, or immediately after a

rain. If you put it on during a slight sprinkling of rain, —and it don't hurt a person if he gets his coat wet at that time of year,—you will see its effects in a few days. You will see the grass change color, and you will have it a lively green. This was very dry land; and it was very dry, especially the last part of May, and I did not expect to cut the grass before the 15th of June. It was in blossom the 1st of June. I took this method of hastening the maturity of the crop. Just as soon as there came a moist day, we carted out as much of this liquid manure as we could. I think a man with a few pails can carry out a great deal more than a horse can draw out of sand. I know this much, that there is nothing that will start grass so quick as liquid manure. I have this advantage over a great many who have no cellar under their barn. They lose the liquid portion of their manure, which I consider about equal in value to the solid part. I will give you my word for it, that there is nothing that you can apply to grassland that will act so quickly and efficiently as the liquid part of your manure put on in a moist time.

Mr. UPHAM (of Sturbridge). I understand my friend Whitaker's land is light, gravelly soil. Is not that so?

Mr. WHITAKER. Yes, sir.

Mr. UPHAM. I would like to ask him if he has had any experience in absorbing his liquid in sand, and putting it on clay or wet soil.

Mr. WHITAKER. I have never had any experience of that kind; but I will tell you what I would do if I had such land. I would not put the sand into my barn-cellar, and draw it out again: I would put the sand on the clay and plough it in, and put the manure on afterwards. I would not be foolish enough to put it into my cellar, and draw it out again.

Mr. HUBBARD. I want to say one word in favor of sand. Perhaps these farmers will laugh at me (I have been laughed at in my neighborhood) for hauling sand into my barn-cellar for bedding for my cows, for the sake of getting all the liquid into it possible, and drawing it out, and spreading it on low, moist land. My neighbors said I was very foolish, and my hired help said I was very foolish; but, if you will come to my place to-day, I will show you a large hole from which

my neighbors ask the privilege of drawing sand to put under their cattle in the same way; and I will show you a field where I have put sand soaked with manure, and have cut two heavy crops of grass this year, and expect to cut two heavy crops next year.

Mr. Whitaker. I would like to ask the gentleman if the heavy crops of grass that he cut were the result of drawing the sand into the barn, and then drawing it out, and spreading it on the land, or the result of using the sand and liquid manure, which could be just as effectually spread separately; if drawing the sand under the barn, and mixing it with the manure has imparted any properties to the manure which it did not possess before, or to the sand which it did not possess before. Has he not been doing just about the same thing (as I suggested to my man) as mixing whiskey with water, and spoiling one with the other, without any advantage? I will admit that the application of sand to some kinds of land is beneficial. I have seen fine gravel put on a low meadow, and good grass or clover brought in, without any other manure whatever, simply by letting in the air: it had the effect to lighten up the soil to a certain extent. I have seen sand put on and ploughed in, and a good crop of grass follow, without a particle of manure.

In regard to this matter of the improvement of land, and every thing else, we want to experiment carefully, so as to be sure that we are not doing something that is merely labor thrown away. We cannot afford to throw labor away: we must economize it as far as possible.

Mr. Sessions (of Hampden). It seems to me that in all our recommendations here, in all the axioms of agricultural truth we lay down, we should be careful that we do not make ourselves appear ridiculous. Now, although I coincide in the main, and almost entirely, with the thoughts put forth by Mr. Slade, yet I agree entirely also with my neighbor here Mr. Hubbard, in his idea of top-dressing. Some one said that Mr. Slade was talking about Bristol County. He did not tell us he was talking about Bristol County. He laid down the proposition squarely, that it is not economical to top-dress land. When we are talking, we ought to be careful that we do not say something that will seem ridiculous to other people. The gentleman who has just sat down says

that he carries out his liquid manure by hand, and spreads it on his land. If he has a small place, and keeps a horse and a cow, he may do this; but, if he had fifty acres of mowing that he must fertilize this fall, he could not carry it out with a bucket, and spread it over fifty acres. I do not believe we can any of us lay down a rule which will be applicable to all, under any circumstances. As far as I can see, from experience, and from what others have said, it seems best for me to use absorbents. I mean to use those that have elements of fertility in them, if I can find them; if I cannot, I will take sand, and by this means I am able to use my liquid manure, which we all agree is worth quite as much as solid manure. What we want is a vehicle to get it on the land, that is all.

Mr. HUBBARD (of Brimfield). There is no rule that can be laid down that will hold good universally in agriculture. In manufacturing, there can be rules laid down by which manufacturers can be governed, and which will work the same in different localities; but in agriculture it is impossible to lay down any rule that will work the same in all localities and on all kinds of soil. Now, this matter of the use of absorbents depends altogether on circumstances. On my own soil I would use sand; and why? Because it is the very best thing that I can use on my soil. What is my soil? It is a tenacious clay, and it needs something opposite from what I have got. Had I a sandy soil, I would not lay down the rule that I would use sand as an absorbent on that soil; but I would try something exactly opposite from what I had.

Now, in regard to absorbents: I would put sand in the barn-cellar, I would put it in the yard, I would put it everywhere, for an absorbent for my soil. Being a tenacious clay soil, I want to put something upon that soil which will make it more porous; and sand will do this very well.

In regard to top-dressing, it depends very much upon circumstances. I would put this sand used as an absorbent on my grassland as top-dressing; and why? Because my experience has taught me that that is best for my soil. But it would not answer the same purpose under all circumstances and in all places. So, as was observed by Mr. Slade in his lecture, we have got to study and know what our location is, what our soil is, and what are the influences which are

brought to bear upon us; and then we must exercise our own judgment as to what is best for us to use for an absorbent, and what is the best way to use it. Some say, "Put your manure upon the top, and keep it as near the top as possible." Now, in my experience, I have raised the best potatoes I ever raised by putting coarse stable manure on top, turning it over, and planting my potatoes on top of it. By the decomposition of the manure, it is brought into a state fit for the use of the tubers. They are all the time after something that will feed the plant. A plant wants food just as much as an animal.

Now, as to allowing weeds to grow on our farms: we might as well turn our cows into a pasture, and then turn in our sheep also. What the sheep are taking away, the cows cannot have. What the weeds are taking up of the fertilizing elements that are in the soil ought to go to promote the growth of the plant. If the weeds take it, the plant cannot have it, any more than the cows can have what the sheep take.

Capt. MOORE (of Concord). I should not disagree with my friend Hubbard in regard to some things that he has said; still I think we cannot all agree with him when he says that we cannot agree upon any thing. In regard to putting stuff into the barn-cellar, I think we can all agree upon one thing about that, and that is this, not to put a shovelful more of absorbents in the barn-cellar than is sufficient to soak up the moisture. There is the point exactly; not to cart your whole farm into the cellar for the sake of carting it out again. That I think we can all agree upon.

Then, if you are going to put an absorbent into the barn-cellar, what will you put there? One gentleman says sand; another says loam; another says clay. Now, what are the facts in regard to those materials? Sand is small particles of stone, and will absorb but very little for its bulk. Loam dried or clay dried will absorb four or five times as much as the same bulk of sand. Now, I think it is a question, if you really want to use sand on your low land or your clay soil, whether you should cart, at great expense, a large quantity of sand into your cellar for the purpose of carting it out, when you can put a more manurial material there in some easier way. It does seem so to me.

Now in regard to top-dressing. I have done a great deal of that. I have put hundreds of loads of stuff into my cellar for the sake of composting it. When I was younger than I am now, I thought every load I carried out was a load of manure. But I would not put in a shovelful more than enough to absorb the liquid part of the manure. You may put in two loads of sand to one of manure; but you will not get three loads of manure when you draw it out. I have no doubt that if your barn-cellar is cemented, and you have a way of catching the liquid manure in a tank, and some cheap way of distributing it on the land, it would be cheaper than putting absorbents into your barn-cellar. I don't think I should adopt Mr. Whitaker's plan of lugging it out in an old iron kettle.

Mr. Whitaker. Allow me to state that I was trying that for an experiment. I did not want to buy a large wheelbarrow to try an experiment when I could try it in a way that did not cost three cents. If I was going to use my liquid manure in that way, I would get a barrel, put a plug in at the bottom, put that barrel on wheels, pump the barrel full, then take it out to the field, pull out the plug behind, and let it sprinkle on the land.

Capt. Moore. In regard to top-dressing land, I am not going to say here that it is not desirable to top-dress land. I have done a great deal of it, and may do some of it yet; but in my own case I am satisfied, although I have hauled hundreds of loads of compost on to mowing, that it is not for my interest to do it now. Why? Because I have adopted a plan in which I mean to plough my land once in five or six years. Now, don't you imagine that I do not grow good grass. There are gentlemen here who can tell you whether I grow grass on my farm or not. Don't you imagine, any of you, that you grow a great many more tons to the acre than I do; because if you do, if you come to my place, you will have occasion to change your opinion. I don't stand up here to brag about it; but it is well understood in Middlesex County that I raise pretty good crops of grass on my farm.

It don't get manured by merely driving a cart over it: it is manured with the very best manure sufficient to carry two crops a year for about five years, if not six, — big crops too. The land that I seeded the very week before the meet-

ing of this Board last year produced two heavy crops this year. The grass lodged on the ground. I seed a good deal of land late. This fall I have seeded eight or ten acres. I presume I have not more than twenty or twenty-five acres that is in English mowing. I have a few acres of good meadow besides. I keep four horses the year round to do the farm-work. In my barn there are thirty head of cattle that will be wintered there. I sold fifty tons of hay last year. A portion of those cattle are kept on this meadow-hay. I keep them on that hay because I want to work it up. I don't undertake to make milk with that. I keep some milch cows for my neighbors, and run them through the winter on that swale hay, and they come out in good order; and they pay me seventy-five cents or a dollar a week for keeping them, and that is better than making milk, and getting nothing for it.

Mr. ——. I want to ask what the nature of your soil is, and how much manure you apply to get two crops for five years.

Capt. MOORE. I can't tell the number of loads, but very likely fifty loads to the acre of such manure as I have. It would not be good economy to sell off the hay, unless I had some means of obtaining manure. I buy the manure from a stable of forty horses. Mind you, I am doing some considerable market-gardening, and I use large quantities of fertilizers besides. If I was going to put any top-dressing on my land, it would be fertilizers. My soil is some of it underlaid with peat; and the other part of it, where we grow grass, would be called black loam. I have but little clay soil on my place.

I said I thought I should use fertilizers if I top-dressed my land. The natural question for you to ask me is, "What would you use? Would you buy Stockbridge Fertilizer, would you buy bone-meal, or would you buy superphosphates?" I should tell you at once that I should not do any thing of the kind. I should do just precisely as Mr. Slade has intimated in his paper. I should post myself up in those matters: I should use my brains about that, and that is what I have done. I should use the material that would give me the most of what I wanted to put on that land at the lowest price. If I wanted dissolved bone, I

should get the fine bone, and dissolve it myself; then I should know that I had dissolved bone. If I bought it of a dealer in fertilizers, I might suppose that I got it, but I should not be sure.

Mr. Merrill (of Pittsfield). I would like to have Mr. Moore tell us the kind of manure he applies, and how he applies it.

Capt. Moore. It is manure that comes out of my barn-cellar. I keep a good many pigs on it. It is manure from the cattle; it is coarse manure from the stable run into that cellar through scuttle-holes in the floor, and worked over by the pigs; it is the waste of the farm, every thing of that kind I can get. Perhaps I ought to say, further than that, that my land is not all turned over simply for raising grass: perhaps there is a rotation with some other crop. Usually I raise two acres of cauliflower. I cannot grow cauliflower without manuring the land heavily. No man can grow cauliflower without an abundance of manure. In growing cauliflower, it is absolutely necessary to use a great deal of phosphates in the form of bone, and with that I use potash in the form of muriate of potash or sulphate of potash. On that piece of land after it has had cauliflower on it, I should not plant any other crop, like corn, because hardly any crop, except grass, grows well after any of the cabbage tribe: you may be sure of that. I have found that out by experience. My experience has cost me a good deal of money when I have tried to grow something else besides grass on land where I have grown cauliflower before it has had a rest. Most of my grassland has a rotation; and it has a rotation after a crop which has been very highly manured, and has not, perhaps, exhausted the elements which the grass wants.

Mr. Taft (of Upton). Will you tell us how you put on your manure, and how you manage your land that you turn over in August, after you take off the crop?

Capt. Moore. I do not like to seed it until the middle of August. Anywhere from the middle of August to the first of October is safe for us. It is not very safe for a person who does not manure well to seed much after the first week in September. I plough the land, and put on a wheel harrow,—a Randall harrow. My land, I may as well state

here, has no stones, no stumps, or any thing in the way of the harrow.

Mr. TAFT. You do all that before you put any manure on?

Capt. MOORE. I do all that. Perhaps I go over the land with a wheel harrow once, and then put on the manure. That land is thoroughly pulverized, and the manure mixed with it, before it is seeded. The work is well done. It is very important it should be well done.

Mr. TAFT. The result is, you get two crops a year for five years?

Capt. MOORE. I do get, somehow or other, two crops a year for five or six years; but it takes heavy manuring. I have ploughed in a good deal of manure; but it is not economy on my land. I would say, that if any gentleman is very desirous of composting manure, if he will turn over a piece of land, and will work that manure in two inches deep, where it will have the influence of the sun and the influence of moisture, I would like to have him tell me how he can compost it any better. I do not know any better way; and certainly it does not cost as much as it does to overhaul it two or three times, and you have as much manure as you have in any other way: there is none of it lost. I used to think a great deal of manure was lost by spreading it on top of land in the spring, and harrowing it in; but I have come to the conclusion that there is but very little of it lost. Perhaps when you go by a field, you can smell a disagreeable smell, and you say the ammonia is all going off. Just think of it a moment. A dead cat will scent the air over four acres for two weeks, and you don't believe you have lost a great deal of ammonia by that. I don't think there is so much manure lost by spreading it on land as has generally been supposed.

But there is something that I wanted to talk about more than I did about manure; and that is the subject that has been brought up here to-day by Mr. Grinnell. He referred to the fact that our hill-towns are losing their population, and the farms are being deserted. Mr. Slade said in his paper to-day, that there are some farms run down and deserted even in Bristol County; and all who have spoken on the subject have regretted that our young men leave the

farms, and go to the city. Now, I think it is a laudable desire on the part of every man who has been brought up on a farm to keep that old homestead in the name of the family, and keep his sons on it. How will you do it? I believe it is the fault of the farmers themselves, more than three-quarters of the time, that their sons do not stay upon the farm, and make good farmers. Many farmers (I know there are exceptions) want to save every dollar they can get on the farm. They skin every thing they can get about the place, get every dollar they can, and put it in the bank for their children. Now, I have thought a great many times that if a farmer, instead of doing that, would beautify his place, clear up the door-yard, remove the old wagons, and old wheels, and old rotten sleds, and piles of lumber, and make a beautiful lawn in front of his house, and would allow his son — the son will be the progressive one, you may be sure of that — to plant some trees, and ornament the house; if he would go to work and put proper books in the house for that young man to read, let him have company, and, if he has daughters, give them a piano, and let them play on it, and have a good time generally, — if the farmer would make that home the best place and the most comfortable place on the face of the earth, that boy will never go away, just as sure as you are alive.

Mr. Taft. What are you going to do with families where there are eight or ten boys?

Capt. Moore. It is very proper that some of them should go away. You may be sure that they will come home and bring some money to help beautify the place. You want to make the home beautiful, so that the young men will want to come back to it. Don't think you are going to beautify your farm by putting up an expensive fence in front of the house. Much money has been thrown away by putting up expensive fences, that are offensive to any person of good taste; as much as to say, "My line comes thus far, don't look the other side of it!" Go into a village where the fences, as I have seen in some places, have all been taken away, and see how much more beautiful it is, and what an expense is saved to the farmers in the village, and to the people in the village. If there is any gentleman in this room who lives on a village lot, perhaps twice as wide as this hall,

with a fence in front of his building, and a division fence between him and the next man, when he looks out of his window, he is reminded that he owns to that fence, and not an inch beyond. Take the fences away, and he will imagine, at any rate, that he owns every thing within his sight, and it is certainly more beautiful. You would be astonished if you knew the amount of money which is foolishly put into fences.

Mr. EVERETT. I wish to say a word or two in relation to the question of absorbents, as that topic has been presented. I have some neighbors who practise carting sand into their barns as an absorbent; but it has always seemed to me a ridiculous thing to do, and the same opinion has been expressed by Mr. Moore and Mr. Whitaker. Sand has been carted upon low land on my farm with great advantage. I did not put it there as an absorbent, however. My father practised it fifty years ago on low land. He had a piece of low land of four or five acres; and he covered an acre or two, at considerable expense, with sand and gravel, and raised good English grass upon it. He did not cart it into the barn-cellar first, and make three times as much work in carting it in as an absorbent, and then carting it out again. I have understood the term "absorbent" to mean that which will soak up and hold the liquid manure. That is all that I have ever carted into my barn-cellar. I use sawdust as an excellent absorbent. I use muck, taking it out of the swamp, as Mr. Whitaker has stated, letting it freeze one winter, and dry the next summer; and the next fall I haul it in, and use it as an absorbent to take up the liquid manure of the fifteen or twenty head of cattle which I keep in my barn. Instead of going to the expense of carting in sand, and carting it out, you may take something which is very light, and which has much greater absorbent power. Sand absorbs very little as compared with muck or sawdust, from the fact, as has been stated, that it is composed of little round stones, which cannot absorb much. It seems to me we ought to use the finest and most pulverized material we can get that will suck up and hold the liquid manure. That is all we need, and all we should ever adopt.

Adjourned to seven o'clock.

Evening Session.

The meeting was called to order at seven o'clock to listen to a lecture on the

HYGIENE OF THE FARM.

BY EDWARD HITCHCOCK OF AMHERST.

Ladies and Gentlemen, — The subject on which I am requested to express a few thoughts to you this evening needs no plea for its importance. No sane, no honest person desires to be sick or injured, or pretends to be in the bonds of physical or mental disease. And yet there are some difficulties in presenting this subject even to so enlightened an audience as the present one. For personal and home health and comfort are matters about which almost all persons have some definite and positive ideas, acquired by their own manner and methods of life, and, if they are getting on in life, they have had them for years; and we all are mightily influenced by our personal experiences; and advice offered contrary to these is received with an ill grace by almost everybody.

When we are thoroughly sick, disabled, or injured materially, most of us are apt and willing to put ourselves in the hands of our physician, and are anxious to follow his advice, even if we have to borrow money to do it. There are cases where no previous knowledge or experience has been gained by us: we are seized by pain or distress which we cannot relieve, and we are ready at once to run for the doctor, who, we believe, can help us. We feel that he has skill, knowledge, and experience which may give us relief, and implicitly follow his directions.

So much when we are diseased, — when we know we are in the hands of a potent, and it may be malignant influence; when we can see, feel, and know, that certain parts of us are decidedly in disorder or distress; when something outside of ourselves must be done, and that immediately. And when we feel that some drug, some instrument, or some knowledge, will give relief, how ready we are to seek it! yes, how credulous we are even to paying our money out freely for patent-medicines, or to the man who advertises the loud-

est in the newspapers that he can surely cure us! But when the case is before us whether we can maintain our health equilibrium, whether we can keep ourselves well now, as we always have done; when we are told of some new idea about our own health or that of our neighbors, — an idea that is at variance with our own experience, and that, possibly, of our fathers and mothers also; then it is often the case that we think we know well enough ourselves, and are not to be led astray by ideas because they are new, or by any visionary scientists who make ever so nice theories, but who have not had the experience of ourselves. For example, when anybody tells a Massachusetts farmer that his well-water is not pure, is unhealthy, will he not quote the history of that farm and its possessors perhaps back to 1776, and tell how healthy its occupants have always been? Or when the good wife is urged to put more flannels upon youth, children, and even adults, does she not sometimes say that our grandmother and grandfather lived to be ninety years old perhaps, and yet never wore undervests or drawers? And perhaps she quotes the Indians too. And will not many men (though these are not generally farmers) when reasoned with about the use of alcohol and tobacco (especially when they love the stuff) at once quote the octogenarians who have "taken something" for forty or more years, and smoked or chewed longer, as an unanswerable argument why they may drink and smoke?

Oh the force of habit is so strong! and the force of those habits which give us transient ease and present comfort and pleasure! 'Tis so much easier to snug down in the warm lap of luxury, ease, sensuous present pleasure than to brace up to strong and vigorous work, to resist the power that lulls us to sleep, or which says, Don't work so hard, or, Enjoy life as you go along!

The population of Massachusetts is 1,651,910 souls, as determined by the census of 1875. Of these, 70,945, or about one in twenty-three (1: 23), are engaged in the occupation of agriculture. And the consideration of our subject requires us to ask what is the health of this portion of the community.

It is not possible, however, to make as accurate returns of the health of a community as it is to know, for instance, the

number of people in a town, the rate of taxation, or similar points, because the standard of health is not an invariable quantity. Not every one is equally sick; and what is downright sickness to one person is only an inconvenience to another. Hence the only absolute and numerical standard of health, imperfect though it may be, is the number of deaths, and their ages. On these points we have more than approximate data.

Fortunately for ourselves, our own Commonwealth has the oldest, the most perfect and accurate system of records of births, marriages, and deaths, of any State in the Union; and we have just issued the thirty-seventh of these annual reports by the honorable secretary of state, with the compilations and calculations carefully wrought out by Dr. C. F. Folsom, the secretary of the State Board of Health, Lunacy, and Charity. In Table XIII of this Report we find statistically classified the number of persons in the whole State over twenty years of age who are engaged in some one of the ten occupations specified, and the average age of the deaths in each occupation for the past thirty-five years and eight months.

The following table shows the average age at death of the citizens of Massachusetts, for the last thirty-five years, who were engaged in one of the following occupations, and were over twenty years of age: —

All classes and occupations	51.15
Cultivators of the earth	65.57
Active mechanics abroad	53.05
Professional men	51.27
Merchants, financiers, agents, &c.	49.06
Active mechanics in shops	47.97
Laborers, no special trades	47.91
Employed on the ocean	47.15
Inactive mechanics in shops	44.45
Females	39.72
Factors laboring abroad	37.42

Some twenty-five years ago, Dr. William Farr of London, now an octogenarian in full vigor, devised a new classification and arrangement of man's diseases in place of the previous classification of Cullen, which was utterly unscientific, and established on mere theories and vague notions of previous

years. This system has for its basis the causes of disease, and, by it, all diseases are divided into five classes: 1. The Zymotic; 2. The Constitutional; 3. The Local; 4. The Developmental; 5. The Violent. These five classes are divided into twenty-one orders, and these twenty-one orders into an undetermined number of so-called diseases.

	In 1878.	Per cent in 37 years and 8 months.
Deaths from all causes	32,564	
Zymotic diseases	7,666	27.93
Constitutional diseases	7,688	23.63
Local diseases	10,549	25.23
Developmental diseases	4,628	16.19
Violent diseases	1,196	3.99
Unknown	822	3.03

ZYMOTIC DISEASES.

Small-pox.
Measles.
Scarlet-Fever.
Diphtheria.
Quinsy.
Croup.
Whooping-Cough.
Typhoid-Fever.
Influenza.
Cholera.
Rheumatism.
Syphilis.
Alcoholism.
Worms.

DEVELOPMENTAL DISEASES.

Diseases of Childbirth.
Still-Birth.
Premature Birth.
Teething.
Old Age.
Debility.

ACCIDENTAL DISEASES.

Fractures.
Wounds.
Burns and Scalds.
Drowning.
Poisoning.
Battle.
Homicide.
Suicide.
Execution.

CONSTITUTIONAL DISEASES.

Apoplexy.
Paralysis.
Insanity.
Epilepsy.
Brain-Diseases.
Heart-Diseases.
Bronchitis.
Pleurisy.
Pneumonia.
Lung-Diseases.
Rupture.
Stomach-Diseases.
Liver-Diseases.
Diabetes.
Kidney-Diseases.
Gravel.
Uterine-Diseases.
Joint-Diseases.
Skin-Diseases.

With this formidable array of diseases assailing us from before and behind, and at either side, above and all around

us, within and without us, it almost seems as if we must decline to continue on with the battle of life, and not attempt to live at such fearful odds. And were it not that human science, skill, practical experience, will, and faith have such a mighty power to resist many forms of disease, and even keep Death himself at bay for a while, we might, at least, pity every new-born babe that is ushered into our world.

.If we compare the health-records and the death-rates of the past with those of the present, imperfect though they are, we can surely see that civilization, modern improvements and discoveries, together with Christianity, have done much to reduce the death-rate, and increase the health-rate, of the individual and the community.

Nations, states, villages, and communities are beginning to learn that obedience to the laws of health is wealth, strength, comfort, and pleasure to everybody.

The establishment during the past year, by our United-States Congress, of a National Board of Health under governmental power, is a good indication that the health of a whole nation is a matter worth legislation, and spending some money upon. And the more recent organization of an American Public Health Association, to secure the advantage of the popular as well as the governmental power in this work, indicates that people are beginning to believe that at least many of our pestilential diseases may be effectually trampled upon, if they cannot actually be stamped out of existence. Also the maintenance of our Massachusetts Board of Health for the past ten years shows us that the old Bay State knows that to neglect the bodily and mental health of her citizens is an evil nearly as great as would be a neglect of school education and morals. Nay, more, is she not willing to go still farther, and declare that to neglect bodily health is a most sure way to bring on a neglect of culture of mind and soul? Has not the all-wise God connected soul and body in such a mighty and mysterious manner that we may well fear we shall see a handwriting on the wall, "What God has joined together let not man put asunder," if we fail to heed this union?

"In ancient Rome, in the period two hundred to five hundred years after the Christian era, the average duration of life in the most favored classes was thirty years."

In Geneva, Switzerland, the expectation of life from birth in the sixteenth century was 21.21 years; in the seventeenth century, 25.67 years; in the eighteenth century, 32.62 years; while to-day it is about 40 years.

The Massachusetts Board of Health says that as large a proportion of the population now live to seventy as lived to forty-three three hundred years ago.

These dry figures show us that there has been progress in the length of life during the past few centuries. And as a large majority of persons die of disease, rather than by violence, accident, calamity, or starvation, it must be that this increased longevity is because man has learned the laws of disease and the means and methods of resisting it. Man, in the struggle for existence, has been watching his worst and ever active enemy, and is evidently getting the start of him again and again.

But let it not be understood that this gain is entirely in the art of medicine, — of healing disease, of restoring disordered parts, — though we cannot give too much praise to the men who have made the great discoveries in these directions, and are daily and hourly making them of immense benefit to us. One great excellence of a good general with his army is, not merely to be able to do the best fighting, but to have and keep his army in such condition, position, and surroundings, that he can strike heavy blows when it is necessary. He must know the strong and weak points of his enemy, must have his reserves ready and strong enough, all through and through, to meet reverses, surprises, and other unforeseen events. It requires profound research and diligent labor to know how to heal the wounded or diseased body; but a great study for magistrates, benefactors, educators, and the church, is to learn how to *prevent disease or pestilence*, how to secure healthy stock, how to keep seeds of disease from being sown, how to promise a fair inheritance to the child as it is thrust into this world where is so much of danger, peril, and hardship.

This knowledge requires research and investigation by the best of minds, and by means which must be furnished by the State as much as must its methods of collecting taxes and revenue, or its post-office department. Experiments and investigations must be carried on, in such a way and

with such magnitude, by the State, because they require a pecuniary outlay beyond the depth of individual efforts and private purses. Authority must be had to pursue and investigate where local prejudice, greed, and selfishness will do all in their power to hinder and overcome. The strong arm of government must come in to force men to relinquish practices which are pernicious to the people, even if they demand a sacrifice of money, habits, prejudices, and notions.

Our reliable authorities now declare to us that at least one-third of the diseases of modern life are preventable; and, to confirm this statement, localities can be mentioned where the death-rate has been reduced several per cent in a few years by a practice in the direction of this idea. One instance must suffice. At North Wickford in England, in 1840, the death-rate was twenty-seven in a thousand; and in 1867 this same rate was reduced to seventeen in the thousand, — a diminution of ten per cent in twenty-seven years. And while one-third of *all* disease may probably be prevented by obedience to the laws of public sanitation, a much larger per cent can be reduced among the *zymotic* diseases, the filth, the contagious and infectious diseases; those in the main produced by a fermentable poison in the soil, water, or air, — a poison which is mainly furnished by the decomposition of the waste, the filth, the necessary excreta of man and domestic animals, when not properly cared for. Dr. Simon, chief medical officer of the English Privy Council, says that "the deaths which we in each year register in this country (now about five hundred thousand) are fully a hundred and twenty-five thousand more numerous than they would be if existing knowledge of the chief causes of disease as affecting masses of population were reasonably well applied throughout England;" and this is, I believe, the common conviction of persons who have studied the subject. Surely an impressive thought, that the lives of a hundred and twenty-five thousand people could be prolonged, if only a few simple rules of health were better known and more faithfully carried out!

Prominent among these diseases, and one specially affecting the farmer's life, is *typhoid-fever*, — a disease usually springing from his carelessness or ignorance; one whose germs are produced under his own eye, on his own homestead, and because he neglects his own filth.

Of all the diseases which in Massachusetts, for the past thirty-seven years, have been reported as the cause of death, typhoid-fever has furnished 4.70 per cent, or about one in every twenty deaths. Nearly five per cent of our Massachusetts deaths seem to be the result of typhoid-fever. And the Registration Report for 1878 tells us that this disease "*is most prevalent in the rural districts.*" Yes, among the farmers who have the longest lives, we find the largest per cent of a most potent filth disease.

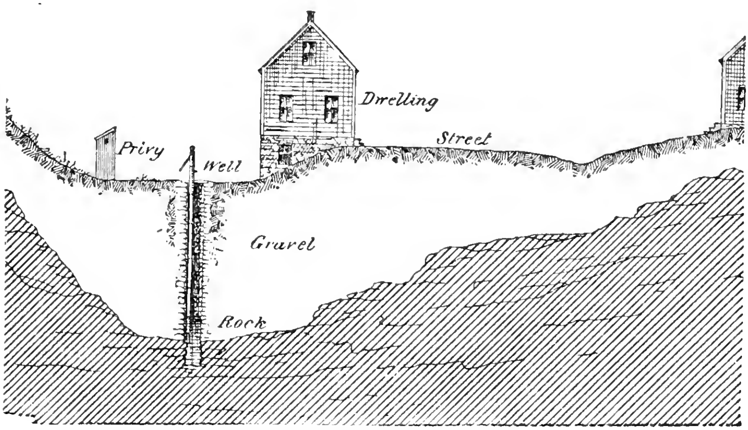
Now, why is it that the farming population suffer more from this fever than do the crowded city populations, with the condensation and accumulation of their animal excreta? Does it not seem that it is gross negligence, or a serious ignorance, which allows these pestilential germs of a fatal disease to accumulate in the air and water of the farmer living on the broad acres of his domain, where all such sources of disease may be so easily, and at the same time profitably, disposed of?

In a very recent letter from Dr. Folsom, the secretary of the Massachusetts Board of Health, Lunacy, and Charity, he says, "I have just investigated eight cases of typhoid-fever, probably due to one well, and am started on another which seems responsible for thirteen cases."

The startling fact is here forced upon us, that probably much of typhoid-fever, and other zymotic diseases, is produced by drinking the water from the artificial wells which supply so large a part of our country population with drinking and cooking water.

Formerly it was universally believed that no water was so pure as that procured from a well dug in the rock or soil of the house-lot; and in many cases it still is a true fact and belief. Where there is the proper condition of soil, and freedom from filth contamination, we are sure of pure water, or water free from organic impurity. But the fact is now recognized, that, in many localities, both air and water travel very freely under the surface of the soil we tread and live upon. This is usually owing to the geological formation upon which we live, or, in other words, the kind of soil or rock beneath us. In some places the soil is so porous and deep, that water will readily settle through it, and the filth be retained in the top loam, so that ordinary cultivation, and

specially the vegetation upon it, will absorb and destroy the filth element. In such a case, the water will be pure, and safe to be used by men and animals. But in other conditions, — such as where wells are shallow, and dug in a clayey or impervious soil; where near to or at the bottom of the well is a stratum of hard-pan, clay, or other impervious strata, — the well is often only a receptacle for much of the drainage of both house and barn, and that for many square rods of superficial area. And, if we are rightly informed, the soakage of sink-drains, privies, and barnyards, of a majority of our New-England farms, is cared for in no other way, save to allow it to get into the soil the best way it can, without aiding it to escape, or be utilized by any methods of drainage.



HOW WELLS ARE POLLUTED.

I quote the following passage as bearing directly on this point: —

"It is impossible to say that a well is safe, at any ordinary distance from a source of constant pollution of the neighboring soil, like a privy, cesspool, barnyard, &c. Often the filth goes a long distance, sometimes not very far. *There is always a risk;* and even if well-marked sickness does not occur, as narrated above, more obscure affections are not uncommon. . . . The ordinary privy should be abolished. It corrupts the air, the soil, and, consequently, too often the wells." — *Circular of Dr. Folsom.*

Now, it is possible that some people will say this state of things has continued for the past half-century on many New-England farms; that the drainage has soaked into the wells; and that perhaps the well is in the barnyard, for convenience

of both house and barn, and we haven't been very much troubled with filth diseases: why stir up trouble among us? Simply because there is no doubt that scarlet-fever, many kinds of sore throat, diphtheria, dysentery, cholera-morbus, and similar diseases, are more or less produced by filth-poisoning as just described; and we would like the farmers to have a "heap less" of them than they have had formerly. We want the farmers to stamp out every bit of disease in their power.

Don't sit on a powder-cask, or the safety-valve of a steam-boiler; because, if you do, the daily papers may some morning give you a short obituary notice.

No! do what you can to stamp out the causes of those diseases which carry off twenty-eight out of every hundred of our population.

And don't wait till you say you can see, smell, or taste the impurity in your well-water. To be sure, the lower animals are furnished with a higher grade of sense-perception than is man, for the very necessity of self-protection in this direction; and this protection is almost perfect in them. But man is much more sensitive to disease than are the brutes, and, in order to protect himself, he has the mental powers superadded to sense. He must reason over and above the sense of smell, sight, and touch. He must invoke chemical tests, microscopic insight, and other elaborate means, to discover his protection. Dr. Simon says, "The zymotic malignity is but indirectly and most imperfectly suggested to us by qualities which strike the common sense, or by matters which chemical analysis can specify." And he even goes so much farther as to say that "waters which chemical analysis would probably not condemn may certainly be carrying in them very fatal seeds of infection; and it is certain, that, in doses in which they can fatally infect the human body, they are infinitely out of reach of the most cultivated sense of smell. We must not assume that the diffusion and potency of septic ferment in the air necessarily go *pari passu* with the diffusion and offensiveness of the fetid gases." [1]

Thus we see that water may and does carry the germs of fatal zymotic disease, which to the eye is entirely pure and transparent; so that while chemistry, microscopy, and sen-

[1] **Dr. Simon's Filth Diseases.**

sation will often aid us in detecting these our secret enemies, we must employ other scouts, if we would know their whereabouts and force: we must give eternal vigilance to the matters of house and barn drainage, absorbing, removing, and destroying one of our most subtle foes.

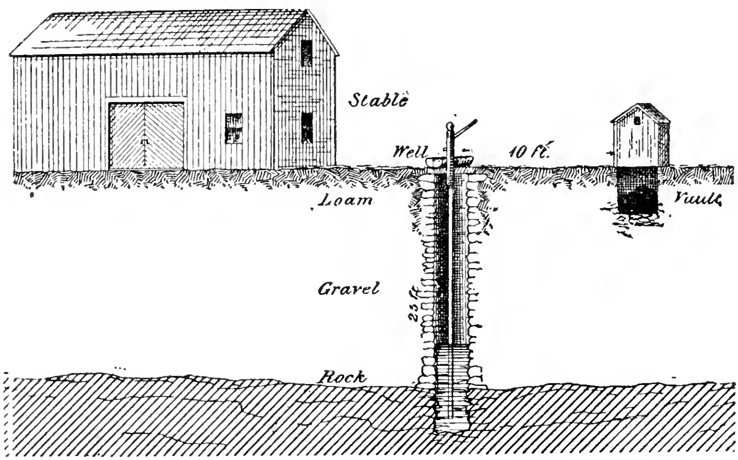
If any of this audience were now to ask the authorities intrusted with the public health, what books and papers to read, without doubt they would, first of all, say, Those pertaining to the drainage of homestead and farm, and the supply of pure water for the farmer and his animals. This subject — as the slang phrase has it — is now "up," and we must always strike when the iron is hot. And probably the matter accessible to every person in the Commonwealth is to be found in the reports of our State Board of Health, in the hands of every town-clerk, and in most of our public libraries.

Now, the first question occurring to the practical New-England farmer in considering this subject, is, How can I secure pure drinking-water? Without doubt the supply from a spring on the neighboring hill or mountain-side, delivered through a wooden or iron pipe, is as near perfection as can be attained in the present condition of our knowledge and appliances. But this course is open to only the few. Probably not half of our population could thus supply themselves, even if inclination and money were ready for it.

Most of us can and must supply ourselves from the time-honored *well*, — and a well near the house, and, better, with the old oaken bucket.

If this be so, how can the well be protected from pollution? How can the farmer, without chemical and microscopic analysis, assure himself that he is properly caring for his family and his cattle in the matter of drinking-water? Rain water gathered from the roofs of buildings, and thoroughly filtered, is not an impossibility; and the authorities say that this is good water. But this requires great expense and care, and is practically out of the reach of nearly everybody. There is no apology or excuse for most householders who do not so locate their well, or protect it when located, that filth shall not pollute it, or prevent their securing good water. Nature has provided two available means for disposing of human and animal filth, so that man can live securely and safely.

One is by an abundant supply of waste running water, and the other by dry absorbing earth, loam, or ashes. Where abundant running water is near, underground drains will dispose of animal waste satisfactorily; and, where this is not practicable, a supply of well-dried loam or ashes daily furnished to the privy, sink-drain, barnyard, and pig-pen, will not only make the possessor feel and smell clean, but he may be sure of a much cleaner bill of health for his household, barn-hold, and neighbors too. Yes, it costs something to haul, keep dry, and deliver this dry earth daily: so any thing of value is costly to secure and keep safely. Who'll part with his wife and children because they are a care and



POLLUTION OF WELLS.

cost to him? And a good horse and buggy kept in proper condition don't come or take care of themselves. Mr. Emerson has somewhere said, "The first wealth is health."

Unqualifiedly, then, the two points to be made in regard to the health of the farm are, to furnish to men and animals good drinking-water, and to be sure that the animal and human ordure, waste, and filth is either carried off by an abundant supply of running water, or entirely absorbed by dry earth.

It is asked, How near may a well be safely located to any of the causes of pollution about the ordinary farmhouse?

Draw a circle about the well as a centre, with a radius three times its depth, and, if no cause of pollution be found

within the circle, the occupant may feel safe. If, for example, a well is fifteen feet deep, there should be no sink-drain, barnyard, or privy, within forty-five feet.

The two accompanying cuts from a circular issued by the Massachusetts Board of Health show what is a too common condition of things as connected with the source of water-supply to the ordinary farmhouse, and the sources of house and barn filth about it.

But some one asks, Why not cesspools? Haven't they always been used, and are they not everywhere now? Too true, alas, too true! And, if the causes of our pestilential diseases could be fairly written out, he would be a dull scholar who didn't learn that first-class diphtheria, scarlet-fever, dysentery, and their sisters, often claim a parentage at the cesspool.

As some one has said that the cesspool is the "king of stinks," so it must be added it too often is a prime cause of many dangerous diseases.

And yet, in some cases, it is almost a necessity that cesspools exist. There are certain conditions of location and surroundings that seem to compel their existence. A blind cesspool whose only outlet is the soakage into the immediately surrounding earth, and which is seldom if ever emptied, should *never be tolerated.* To be sure, the most faithful mother-earth will absorb and deliver over to plant and tree roots a great amount of death-producing filth; but sooner or later, and sooner in some soils than in others, the absorptive power is exhausted. One, two, or three years may pass, and all be lovely; but by and by, dysentery, enteric fever, or something of a kindred nature, will break out, and frighten a whole community, and all, it may be, because of a cesspool with its cumulative poison, because a large area of ground soil is full of the fever contagium, and it finds its way seeking to destroy the fairest, loveliest, best, and tenderest in our homes.

Pettenkofer believes that the air conveys the poison from the soil. The only way in which a cesspool should be tolerated by law — and conscience — is to have a water-tight receptacle with no outlet, unless there be plenty of water running near by, or a sewer; which receptacle, whenever full, should be emptied, either into a heap of dry loam, or

spread over a large area on a cool, dry day, thus giving the grass-roots a chance to transmute the fever-poisons into life-giving vegetation.

Col. Waring has proposed and carried into execution a method of disposing of house and town sewage, which deserves a most worthy mention. This consists of a long series and network of porous drain tile laid a few inches beneath a grass-lot, lawn, or home-lot, and all connected with the main sewer or waste-pipe, so that the sewage is continually brought to the rootlets of the turf-land, which thus are able to act as faithful scavengers — and perpetual ones too — of this most undesirable material. This system has worked successfully as the means of disposing of the drainage of the town of Lenox, Mass.

There are other and valuable methods for disposing of house and town sewage; but there is neither time nor space here to enter upon them. Many of them, however, are well illustrated and discussed in the reports of the Massachusetts Board of Health, and, if any one can get hold of this report for 1874, let him not fail to read a most admirable and well-timed paper in that number, on the "Health of the Farmers of Massachusetts," by Dr. J. F. Adams of Pittsfield, supplemented by a valuable paper on a kindred topic by Mrs. Thomas F. Plunkett of the same place.

In close companionship with the subject of filth waste is the inclement exposure in the common country privy. At an average farm house and yard we all know of one prominent building, not large in comparison with the barn, but often more conspicuous. Its location very often, too, is coolly conspicuous, suggestive of dangerous exposure to chill and cold during about eight months of the year.

With proper and not very burdensome care, this important adjunct may be incorporated with the house, and be comfortable and healthful during the dangerously cold months and the dangerously hot months of the year. But it will require some work, and some little constant expense after the proper establishment of it. The water-closet system is, of course, the most complete and safe; but, where this is not practicable, the dry-earth pail, or vault, must be used, and this part of household health be daily attended to as much as is the preparation of the food, the ventilation,

or the proper heating, of the house. How suggestive of discomfort, and distress even, are many of these very old-fashioned establishments, to a feeble and sick person, or to an old person, or a very young one, as well as to those who believe we can be comfortable, and live within the bounds of health, at the same time!

But let us turn to other themes. While sources of the worst disease may demand an early attention, while we shall first want to despatch the enemy who will shoot or throttle us, let us not forget those which slowly and insidiously plot our injury.

We well know that a steam-engine can't be worked without a fire under the boiler; and a horse who can't eat or won't eat will be a poor worker. But there are bad and good kinds of fuel to make steam of; and horse-feed is of more than one kind. We don't expect much work or speed from a horse whose belly is full of green grass; nor can we expect good work from man, woman, or child, in muscle or brain, who is not well fed.

Of course, our farmers have food enough in bulk and quantity. Corn, potatoes, and apples, we are pretty sure of every year; and then there is pork, — the nastiest and worst flesh upon which man can feed anywhere in the world, unless we except the worms which the Chinese eat. Simple filling, however, is not food. Sawdust and bran will delay death from starvation. It is the preparation of food to which reference is now made, — to cooking and the care of the food which farmers eat. At cattle-fairs, it is true, we always have superb shows of bread, butter, cheese, and so on; and were this the universal bread, butter, and cheese of farmers, no doubt we should know much less of diseases of the digestive and assimilative organs among them. But may we believe that farmers as a class have the best bread on their tables every day? Is the bread generally light, spongy, and sweet when it is twelve hours old, — the best age at which bread should be eaten? How many eat the bread when it is hot, and not, therefore, fully prepared for the human stomach well and easily to digest! Not only do many farmers fail to have the best flour to make into bread, but do they always make the lightest and best bread of what flour they may chance to use? Is bread-making a study with our cousins

on the farm? Do they thoroughly know what the best of bread is? How often do they from inclination place hot biscuit on the table? Now forgive the gentle imputation, fair ladies, for we have eaten good bread and as well-cooked food at the hands of some of you as can be prepared, and we have as sadly seen food placed on the table which was dangerous to eat, and all, we believe, because there was culpable ignorance about the cooking and preparing of it.

If accurate returns could be made of the food in farmhouses, should we not find first-class pies, cakes, and doughnuts, and the best of bread, good coffee, and properly-cooked meats, in a small percentage? Now, pastry and all that class of substances are the poorest foods that can annoy the human stomach; and, sad as it is true, they are American and mostly New-England foods.

It is just about as easy, — certainly after we know how, — and makes a home more attractive and delightful, to have nicely-prepared food for the family, even though it be very plain food. A little more care makes amber-colored coffee, clear as a gem, rather than the muddy stuff we are so often called upon to swallow. And most emphatically tea doesn't want to be boiled in order to make it palatable, or even suitable to drink. When shall we learn, on the farm and elsewhere, how much not only character, but morality and religious life, may be influenced by the condition of the stomach and bowels? and when shall we learn that the condition of stomach and bowels depends greatly on the food and drink we put into them, and not always the kind we put into them, but the method in which it is prepared?

It has been said that the frying-pan belongs to us Americans as a national emblem: at least it is very universally used in many of our households. It is a simple, easy, and hasty way of treating many kinds of our food; and almost every farmer's wife is sure to have pork and lard ready and in abundance, which are the essentials to this article of kitchen apparatus. And on one side of the stove, with a real brisk fire, we set the pot boiling or steaming with potatoes and vegetables, and on the companion orifice of the stove put the frying-pan, a thin plate of iron, close to the intense blaze, and at this heat place some tender meat or vegetable, not to be *cooked*, i.e., *made soft* and more digestible, but to be *toughened*, *hardened*, and

made more indigestible. Yes, at three times the temperature necessary to healthfully and properly cook the food, we immerse the delicate albumen or fibrine in the terrifically hot fat, and then let it fry, fry, fry!

Water boils in the open air at 212° F., and at this temperature nearly all of our food is properly cooked. The roasting of large joints of meat, and the baking of bread, demand a somewhat higher and more prolonged temperature in order to reach the interior masses of dough and muscle. But when doughnuts are cooked in boiling lard, they are subjected to a temperature between 500° and 600°, and, of course, affected accordingly.

The large part of our animal food is albumen and fibrine, and, of our vegetable food, starch and sugar; and the human stomach is able to digest any of these substances in the raw or uncooked state. But cooking is employed to make these substances more digestible, to put them into such a condition that the stomach can more easily and readily assimilate them than if they were eaten in the uncooked state. A heat at a temperature of about boiling water is that which makes our meats easier to be dissolved by the stomach-juices, and helps to change starch into sugar, which is always very digestible. Now, if we cook (overcook) our food by so high a temperature that the albumen is injured by heat, of course the nutritive properties are more or less reduced; and if our starch foods are so altered by heat, that they are nearer to charcoal than sugar, of course we are sufferers, and we not only lose the nutriment, but we compel the digestive organs to run through their mill that material which yields no good grist, but wears out the machinery. Hence dyspepsia and bowel disorders. When a thin slice of beef, mutton, ham, or apple or bread, is dropped on this terribly hot frying-pan, a portion of it is at once destroyed as nourishment. And, when many kinds of food are treated to a kettle of boiling lard, the act destroys too much of the tender and juicy parts, which only want to be changed a little by moderate heat.

Pure air in living and sleeping rooms, and enough of it, is a necessity which needs constant attendance and vigilance. And it is probable, with the abolition of the old-fashioned fireplace (which many of the present generation never saw),

that many people now suffer for the want of pure air. For, if it be a question between warmth and pure air, too many of us will have the warmth, but let the pure air go. No sleeping-room has the standard requisite for healthy ventilation, which does not have a clear opening outside the building, by chimney or lowered window, of *one foot area* at least, although an open door into the hall may at times answer the purpose. The air of an ordinary sleeping-room, without good means of ventilation, is unfit to be re-breathed after it has been closed for an hour with the sleeper in bed.

But there are cases where this is overdone. The sturdy old-fashioned idea still prevails, that a cool or cold apartment is the best to sleep in, and is still very correct, if not *so cold* as to require an unhealthy amount of bedding above or below (or both) the sleeper; for a bed can be only healthful as a proper amount of air is passing through it from below upwards while it is occupied.

When we sleep, we need more clothing than when awake and active, since the powers of life are more dormant; and on this very account we need to take pains to have more fresh air by night than by day. And yet is it not the too universal custom to close the doors when we retire, so that we shut off many of the currents which circulate by day? And for the seven or eight hours of sleep no one passes through the room to stir up the air with fresh life.

Let us, then, try to remember that we need the precaution of an opening into the chimney, or the throwing-together of two or more rooms, or the dropping of a window, through all the spring, summer, and fall months of the year, in order to secure healthful air by night. We want the air neither hot nor cold where we sleep. We suffer by restlessness if the air be too hot; and, if too cold, we draw upon the vital energies too strongly for the proper amount of animal heat.

It is still a prevalent custom in many farmhouses to open the bed-room window in the early morning, scatter the bedding on various articles of furniture about the room, and so leave it for six or eight hours, for a so-called airing, and this in the coldest as well as other seasons of the year.

Now, this is thorough work so far as ventilation of bedroom and bedding is concerned: it is, perhaps, perfectly done.

But there are other hygienic duties besides ventilation, which demand care and attention. Animal heat must be cared for as well as, and at the same time with, the ventilation. Pettenkofer says, "The bed must be airy and warm at the same time. We warm the bed by our body, just as we warm our clothes, and the bed warms the air which is continually flowing through it from below upwards."

Now, an exposure of a sleeping-room and its bedding to an open window for from two to six hours a day during half of our year is a needless demand on the animal heat of the occupants of the house and the bed-room. The bed-clothing is so chilled, that it takes away a larger amount of heat than is necessary: there is no need of such a thorough freezing of the bedding, the furniture, and the inner walls of the house by so prolonged an airing of the bed and its clothing. For a proper ventilation, it is not necessary to compel the body to sacrifice such an amount of heat as it must to warm the bed so that restful and healthful sleep can be secured.

A window open on any side of a New-England house for twenty minutes in the morning, when the wind can blow through the chamber at a rate of five miles per hour, will be ample ventilation for a bed-room by day.

Bodily heat can hardly be too carefully attended to in such a changing climate as ours, where the thermometer often ranges twenty degrees in as many hours.

Another topic of no ordinary importance, in connection with the hygiene of the farm, is the mental health of the farmer. And it becomes us to ask the question, if there be need of so much insanity among our farmers and their wives.

In the report of the Worcester Hospital for 1852, it is stated, that, during the previous twenty years, the proportion of farmers who were patients was twenty-seven in the hundred. In a more recent report of the Northampton Lunatic-Hospital, out of the five hundred and seventy-two men admitted as patients, a hundred and twenty-six, or twenty-two per cent, were farmers. It is a matter of sincere regret, however, that reliable statistics showing the effect of occupation on insanity are very scarce, and especially so in regard to farmers, since, in so many hospitals, the distinc-

tion is not made between farmers and laborers. And not only this, but a man is committed to a hospital, and called a farmer, when perhaps he may have been only a hired hand on a farm for a few months preceding his commitment. The fact that there is a large proportion of patients classified by their occupation as farmers in the Northampton and Worcester hospitals is because they are located in a portion of the State where farmers are more numerous, and these are the hospitals to which they would most naturally be committed when insane. And the reverse is true of the hospitals in the eastern part of the State; they showing the occupation of their patients to be much more of the artisans, mechanics, and trades-people.

But, whatever may be the showing of statistics in this matter (and figures do not tell the whole truth), the fact is patent, and a solemn one, too, that very many of our farmers do get into our insane-receptacles, and that these many are a great many *too many*. There is some wrong doing or living, when such a large number of the longest-lived occupation the world over bring up so often at the establishments where the demented, idiotic, furious, raving, melancholic, and weak-minded either are stranded for a time, or are ultimately completely wrecked. And especially so since insanity is brought about much more by causes which affect the bodily health than other states or conditions. For example, in the Northampton Hospital, out of six hundred and eighty-seven patients the cause of whose insanity was ascertained, five hundred and thirty-nine, or seventy-eight per cent, were from physical causes; while but the remaining hundred and forty-eight, or twenty-two per cent, were induced by mental and moral causes. So it is a fair inference that farmers are driven into insanity by other than material and physical impediments, and it is a matter of serious study to learn these causes, and how to resist them.

Dr. Earle of Northampton tells us that *excess* of any kind is a broad cause of insanity to us all. An excess of any thing which draws down our vital power or force will bring on the malady. Nature is exceedingly particular that all her powers, ordinary and reserved, be well balanced.

The uses of alcohol and tobacco are excesses which hatch out much insanity. Mental overwork with bodily confine-

ment, also, is another prominent cause. Religious excitement, domestic troubles, misfortunes, money-losses, are excesses that drive many people mad, because so much of the thoughts and energies of body and mind are excessively devoted to one subject. Hence poets, musicians, and artists who are excessively devoted to their occupations, are notedly apt subjects for insane-hospitals. And there is no more marked cause for insanity than anxiety, worry, fret, strain, and unceasing and monotonous work of every kind.

Let it not be understood, however, that the ordinary work of the farmer is productive of insanity. The work of sowing, harvesting, care of stock and buildings, the good housewife's duties, have in themselves a change and variety, with the differing seasons of the year, which more than compensate for the daily monotony. Good hard muscular work regularly and faithfully entered into with zest and spirit, which brings a good appetite three times a day, and insures a good eight-hours' sleep every night, is a boon which insanity never comes near. But when this work is supplemented with some mental trouble, when to hard hoeing and gathering is added some domestic anxiety, some sharp grief, some necessary fear about property, — any causes which produce mental depression, or a constant dissatisfaction, distrust, displeasure, or fear, — then a farmer's toil may be a cause of insanity indeed. When a farmer can not and will not take occasionally a day or a week to recreate, to visit relatives to see how they get on, learn how they live, get new ideas from other people about work and play (both), when this is not done, then expect to find a man or woman, sometimes both, who growl about the success of neighbors, who bemoan their sad fate, sit down by the kitchen-stove, think, talk, worry, and wear out themselves by considering their hard fate, and thus prepare themselves for an insane-hospital, rather than to fly around, tear and break a good many things, and move on and upwards in the world, and thus set insanity at defiance. An occasional loafing-day with the best clothes on, a yearly week or two spent where you don't sleep in your own beds, drink your own water, eat your own food, see home and familiar sights, but get some new food for thought and reflection, is one of the best ways to fight at long range with insanity.

Without doubt, one cause of the superior healthfulness and longevity of the farmer has been owing to the fact that he has lived in a more natural way; he has known less of artificial life as it exhibits itself in style, fashion, or reaching after expensive and extravagant tastes. Simplicity of life and manner has ever been the characteristic of a farmer and his family. Not only have the extravagances introduced by our late war, and the immense development of the wealth of our country, the railroad and telegraph, disturbed the social and healthy condition of the merchants and financiers, but the curse has crawled down into many a farmer's home. And books, and newspapers too, sometimes work many an incidental evil. To many it seems a much higher grade of life to wear fine clothes, sit in an office or store, give orders, send telegrams, and write many letters, than in plain honest and manly muscular work to earn the daily bread. The terrible mistake has been made — oh, how often within twenty years! — of disdaining manual labor, of looking upon hand, arm, and leg work as not ennobling. Ah, how many fair country girls and boys have got into the slums and purlieus of our cities, and gone down as wrecks, because they disdained ordinary farm-life!

And what is the result of this notion? Why, that our New-England farms are going fast into the hands of small Irish tenants and proprietors who are not beneath work, and the Yankee is running to brain and nerve, and running to them so fast, that he is rapidly running his race out of existence: he is not leaving muscle, belly, nutritive and reproductive organisms enough to perpetuate his kind. And the overworked brains and nerves you will find stored away in the palatial residences at Danvers and kindred institutions; while the humble farmer of foreign extraction is raising neat-stock and neater human stock to supply the maw of the insatiable cities and large towns with its men and women.

O farmers of Massachusetts, do not forsake the simple tastes and habits of the old New-England farm! Do not allow the luxurious and effeminate reachings after art, fashion, and sensuous indulgence, to pollute your inborn good sense, and inheritance of sterling Puritan stock. An old philosopher once said that "many dishes bring many dis-

eases." Let it be added as a more modern truism, that many tastes bring many miseries.

Dr. Earle says, in this direction, —

> "I sincerely believe, that just in proportion as the farmers and their families throw off the habits of industry, frugality, and simplicity, characteristic of their fathers, and adopt the manifold luxuries and extravagances and follies of the present day, will insanity (*pari passu*) increase among them. Industry, perhaps, has not greatly diminished among the agriculturists ; but in a large measure it is directed into another channel, and directed to a different end. I take it, that, among farmers of the present day, there is fivefold the work, and hard work too, done within doors, for the sake of keeping up appearances, and making as much show as the richest of their neighbors, that there was fifty years ago."

Away back among the centuries, before the time when the Saviour of mankind appeared on earth, when the Emperor Augustus became master of the Roman world, there lived a pure-minded Latin poet who evidently would know nothing about the sensuality, profligacy, and extravagance of his times, but who enjoyed the simplicity of the farmer's life and the rural pleasures and pastimes connected with it. To this Virgil, whom every college-boy has read, admired, and remembered, we are indebted for the greatest of didactic poems ever written, and known as "The Georgics," which literally means a poem on the working and use of the land on which we live. Of this poem one author says, "In mere point of style it is the most perfect piece, perhaps, of Roman literature."

And, aside from its style, we cannot *to-day* fail to admire it, because in it is the glorification of manual labor, and labor connected with the farm and the farmer's life.

From the ploughing of the land, the planting of the seed, the ravages of birds, insects, and quadrupeds, the harvests, the care of neat-stock, the raising of bees, to the culture of the grape-vine, and the social pleasures of the Italian rustic's home, we find this genial poet, in his easy and attractive style, ready to advise and instruct his readers. And one critic says of him, "There is in Virgil a vein of thought and sentiment more devout, more humane, more akin to the Christian, than is to be found in any other ancient poet, Greek or Roman." One short extract, however, must suffice

to show us what he felt were some of the pleasures of the farmer's life: —

> "O farmers! fortunate indeed are ye,
> If all the blessings of your lot ye see,
> For whom, far off from all the strife of war,
> The kindly earth pours forth a bounteous store.
> What if you dwell not in a palace high,
> Where haughty gates attract the passers-by;
> Whose doors are studded with the tortoise rare;
> Whose tapestries of gold and bronzes fair,
> White linen colored with Assyrian blue,
> And rich perfumes, adorn the chambers through?
> Yours is a peaceful lot, a life where hours
> Are never troubled by deceitful cares.
> Varied the wealth you own in fertile land,
> Studded with lakes and caves and valleys cold,
> Where, 'neath a tree, sleep seeks your mind to hold
> While kine are lowing gently far away.
> Your homes are blessed with honest toil alway;
> Your sons have learned to want but little here,
> And strive both God and parents to revere.
> When Justice left this world for heaven's dome,
> She spent her lingering moments in your home."
>
> GEORGICS, bk. ii. l. 458–475.

SECOND DAY.

The meeting was called to order at ten o'clock by H. C. COMINS, Esq., of North Hadley. He said, —

GENTLEMEN OF THE BOARD OF AGRICULTURE, — It is a source of pleasure to me to see so large an attendance upon this country meeting of the Board. I am glad to see so many, in this beautiful town in the Connecticut Valley, gathered to hear our discussions. We have assigned almost the entire day to topics connected with the dairy interest. It is one of vital importance to this locality, to the State, and to the New-England States. We endeavor to secure the best talent that comes within our reach to address us upon the several subjects presented at these meetings. I have the honor of introducing to you the Hon. E. H. HYDE of Connecticut.

THE DAIRY COW.

BY E. H. HYDE OF STAFFORD, CONN.

Gentlemen of the State Board of Agriculture, — When I was invited to read a paper at this meeting, I hesitated about accepting the invitation, fearing I could not give any subject the consideration it deserved. Aside from my home business, my time has been constantly called upon, as one of the Cattle Commissioners of our State, in protecting its borders from the invasion of the cattle-disease, which threatened us from the State of New York. Before I had decided, I received a printed programme of your appointments, in which I found myself announced to read a paper on the "Dairy Cow." Had I anticipated this assignment, I certainly should have promptly declined to speak on this vexed and undefined subject. I shall only attempt to suggest such ideas as will elicit a discussion from the dairymen and practical farmers here, that may throw some light on this ever talked of question.

This subject has been elaborated and presented, not so much under this simple heading as in various discussions concerning the comparative merits of different breeds of cows for dairy purposes, by those specially engaged in breeding dairy stock. The Short-horns, the Jerseys, the Guernseys, and the Ayrshires, are many of them owned and bred by gentlemen of wealth and scientific investigation, who have a taste for breeding improved or fancy stock, as it is called, and have the facilities of giving such care in feed and shelter as the ordinary farmer cannot bestow. They have thus been working, or endeavoring to work, out such problems as could not otherwise be solved. In this presentation of various breeds for public favor, each has found the *best* "dairy cow" in his respective class, and has given us remarkable results in regard to the production and quality of milk and butter, which you all have seen recorded. This presentation from so-called scientific breeders and fancy farmers is open to criticism by ordinary practical farmers.

Ayrshires — for hardiness, for quantity of milk of good quality in proportion to the amount of food — have never, perhaps, been surpassed; while they are not so rich in butter

qualities as some other breeds. Yet we have some remarkable accounts of their products and excellency in this line, among some of the first importations. We have the report of E. P. Prentice of Mount Hope, of a heifer, only seventeen months and three days old, that weighed five hundred and fifty pounds, producing during the last week in May, 1854, nine pounds and three-quarters of butter. My experience with them would not warrant me in making so favorable a report, so far as butter is concerned.

The Channel Island cattle embrace the Alderneys, Jerseys, and Guernseys. You are all familiar with their attractive faces. For color and quantity of cream, and the facility with which it is manufactured into butter, they lead the list, and are, on this account, especially popular. But they have been too closely bred, and are, therefore, too delicate and effeminate for the ordinary practical farmer, while they are, perhaps, of all our blood cattle, the largest eaters as compared with what they produce. For many purposes they do not equal some other breeds. Thomas Motley of Jamaica Plain reports one of his cows as yielding five hundred and eleven pounds and three-quarters of butter from the eleventh day of May, 1853, to the twenty-sixth day of April, 1854. The last three months it took five quarts of milk for one pound of butter.

THE SHORT-HORNS.

These valuable and noted cattle have been practically known to us for many years. They are celebrated all over the country for their large size and symmetrical beauty, and for the fabulous prices they have brought. There was a heifer calf of this breed sold in 1875 for twenty-seven thousand dollars, — more valuable, indeed, than the golden calf which Aaron set up for Israel to worship. It was the highest price ever paid for a year-old creature in all beastdom. This calf's mother and her progeny sold for over a hundred thousand dollars. Unfortunately they have not been bred so much for milk of late as formerly. There was a time when they stood in the first rank for dairy use: I am not certain but their constitution while thus bred was becoming impaired. If so, the evil has been remedied by an infusion of new blood from a branch of the family more recently imported. Their

size, however, is against them for the dairy, on most of our New-England soils. With the cross of the bull Logan, out of Louise, we had some of the most valuable milkers we ever had in our section. Perhaps I ought to say here that the pure-bred cow Double Rose was a remarkable milker, giving me at one time fifty-nine pounds of milk daily. But she was too large and heavy to thrive well on my light and rather dry pastures. Otherwise I should, for my own use, look among the best milkers of her breed for the best dairy cow, subject, perhaps, to a single careful cross with a Devon or a Jersey bull.

The Dutch cattle are spread over the country, and are claimed by their breeders as superior to all other blood stock in the quantity of milk they give. Some accounts of them justify this statement. But the quality of their milk is not rich, and the general make-up of the animal is such we cannot recommend them as the dairy cow. I have no means to judge of their grades.

DEVONS.

General reputation does not place the Devons, for gross production, as high as the others that I have mentioned; but for certain uses they are unsurpassed, being the most hardy and vigorous of all the classes, yielding milk surpassingly rich in all its qualities, and of most agreeable flavor, and with constitution unimpaired. They have been greatly undervalued for dairy purposes. P. Holcomb of Newcastle, Del., in the summer of 1843 made from one cow a hundred and seventy-four pounds and three-quarters of butter in twelve weeks, or an average of fourteen pounds and nine ounces per week. During one week she made nineteen pounds, and in three days, nine pounds and a half. I think W. Buckminster of "The Massachusetts Ploughman" invited through his paper gentlemen to visit his herd, and test the quality of the milk, four quarts of which he claimed (I speak from recollection) would make a pound of butter. I would do no injustice to any class; but I believe that for some reason, perhaps it is *fashion*, this class of stock has not fallen into the hands of gentlemen with as ample means, and who have the taste or the facilities to feed, and test their merits, and develop their milking qualities, as has been the

good-fortune of some other breeds. The cross with the Devon bull is a good one on any stock and for all purposes. From this cross on the Short-horns I have had a cow that made nineteen pounds and a quarter of butter per week.

My Devon cow (Gem 134) made two hundred and fifteen pounds and a quarter of butter in a trial of ninety-five days, — a trifle over two pounds and a quarter per day.

Now I have briefly referred to various classes of thorough-bred cattle, with reference to their production in their early introduction here. While the breeders have applied their capital, energy, and all the science they possessed, in the endeavor to give us the highest type of a dairy cow, yet they have fallen far short in giving us what I consider the *ideal cow.* We can describe her; but she does not exist. The cow I want must be hardy, of good constitution, well-formed, no waste flesh or bones to carry, and giving a large quantity of milk, rich in cream and all the other elements of milk. As I said, there are very many excellent cows, but none that combine in the highest degree the excellences of all the different classes. How, then, shall we attain the "dairy cow"? If at all for New England, it must be in the cross of some of the thorough-breds referred to, or, more probably, through a cross with our so-called native cattle.

The natives include every thing but pure-breds and grades. Their early history furnishes us with many remarkable cows, among which the Oakes cow is the most noted, and one of the best types of a purely milch cow. She produced in 1816 four hundred and sixty-seven pounds and a quarter of butter from May 15 to Dec. 20, at which time she was giving over eight quarts of milk a day. More recently comes the Holcomb cow, excelling them all in the dairy yield. I have not the record at hand.

Now this opens wide the door for us, as practical men and farmers, to experiment in the most judicious and economical way in cross-breeding to attain the golden prize. But we cannot "gather grapes from thorns nor figs from thistles," nor good milk nor good yellow butter from white birches or our low meadow broad sward.

To use a grade bull is to ignore agricultural science and progress, and all the well-defined principles laid down for

perpetuating the valuable qualities at which we are aiming. Now, let us work as assiduously and faithfully as do those who engage solely in breeding blood stock. Let us select from the native cow such as have been longest bred in the direct line of the very best milking family stock. In all cases use a pure-bred bull from the best line of milking stock in both sire and dam, and with all the milking characteristics developed in the bull. If this rule should be adopted in all cases of breeding grade stock, and judiciously carried out, the increase of milk and butter in round numbers would be astounding, and we could reasonably look for the near advent of the ideal dairy cow, and those who now persist in using grade bulls would be imperative in their demand for pure-breds.

The CHAIRMAN. The subject is now open for discussion; and, as I see abundance of talent here present, I hope the whole time will be profitably occupied.

Mr. BARBER (of Bernardston). If there is any one subject in which farmers should feel a deep interest, it is in the breeding and care of the dairy cow, and every individual who has had any experience in the matter knows how exceedingly difficult it is to obtain a good dairy cow. It can only be done by a long, intelligent, and systematic course of breeding. This is a matter which requires more intelligence and more foresight than we usually give to the subject; because, under the general condition of things, it is utterly impossible for farmers of small means, or carrying on small farms, to have all the appliances necessary to successful breeding under their control; and it can only be done by the union of a number of farmers for special dairy purposes, either for butter or for cheese, because these acquire a degree of knowledge, of foresight, and close examination of conditions, which can only be secured by constant watchfulness, and having the necessary appliances at hand.

Let me give you a little experience in the matter of breeding, as it were, at hap-hazard; because that is the only way that small farmers can do. I have been engaged in farming for the last six years. I believe in securing the best dairy stock. I started with a grade Jersey. I secured, as I supposed, the best sire; and yet I have not been able to obtain a

satisfactory butter cow. Let me state what I had to begin with. I had a two-year-old heifer, that in June after her first calf, which was in May, had made her seven pounds of butter a week; and, taking a pure-bred of the same breed for the sire, I have not been able to secure a descendant from that heifer that has ever made over ten pounds a week, and only one that would do that in the best seasons of the year. Now, if I could have had the control of the conditions that were necessary to secure a good dairy cow, it seems to me that I could have produced something that was better than that in the end; and yet that is all I have got. After six years, taking every precaution that it was possible for me to take under the circumstances, I have been able to secure but two cows that were satisfactory: probably they are as good as the average cows in Franklin County, with the exception of animals that have been bred by those who have had all the appliances under their control, and have continued in that direction for at least ten, if not fifteen years.

So I say it is an exceedingly difficult matter, this matter of breeding; and I was very glad to hear Gov. Hyde speak of the importance of pure-bred sires. I believe that nothing can be done until we come back to that position, that there shall be no other animal used for a sire than a pure-bred. I believe, further, that we had better pay almost any price for the service of a pure-bred than to have the service of a scrub on any condition whatever, even if we were to be paid for allowing the service, especially if we are to raise any stock. I am so well satisfied of this, that I would go any reasonable distance for a pure-bred rather than take a scrub at my own door.

It seems to me that this is one of the points which we should press, — for I belong to that class of small farmers who cannot control all the conditions, — that there must be co-operation in the matter of stock-breeding, and we must breed for the purposes of the dairy; for that, with us in Franklin County, at least for the present, is the practical business; it is that which pays the best; it is that which will pay the best; and it can only be done by the small farmers uniting. Let me give some idea of my theory of co-operation; and it does not seem to me to be so much a theory, so-called, as it might be, but it is one that could be easily carried into practice.

It seems to me that policy, if not principle, would lead a man to that conclusion. For instance, here are five or ten farmers living in a neighborhood, who are not able to keep more than four or six cows each. Now, if there are ten farmers who can keep six cows each, there are sixty cows. Let those farmers unite and say, "We wish to secure the best possible results of the dairy, and we will decide upon some breed of cow." If it is Jersey, very well; if it is Short-horn, very well: but take that which is decided to be the best, that it is believed will secure the best results. I believe it has been generally decided that the Jersey is the best: others may be equally as good, but no matter. Let those ten farmers unite with this end in view, consult each other's interest, and confer with each other upon the whole matter. They have decided, then, to have one class of cows, and with this number they can obtain a proper sire, and keep him for that special purpose; and then they can secure, it seems to me, in the course of a few years, by constant pruning and constant observation, a class of cows far superior to those with which they began, no matter what their conditions may be, and I should say, secure the *best* cows. It is certain that they can get something that is better than any thing that we have had.

Then, again, in the matter of keeping. There is very much in the food of cows that determines the quality of the milk, or the cream, or the butter, no matter what it is. Now let us consider the condition of our pastures first, and endeavor to prepare them alike, so that they will produce nearly the same quality of feed; then let us endeavor to have our mowings as nearly as possible the same, so that our hay will be of the same quality, so that there shall be a uniformity of results.

Then in the matter of making butter. My theory is, that each and every farmer should make his own butter. We should then have the same dairy arrangements, because that is an easy matter. If we can have running water, so much the better, to secure a uniform temperature of the milk; otherwise, it is a very easy matter, by the use of wells or ice, to obtain that. It requires a little time and a little expenditure; but I am sure that it will pay in the end. Then we have our milk at home, we have skimmed it. If we think

the small pan system is the best, let us take the small pan; if we think that some other method is better, take that; if we think the cold system is better, take that; or, if we think pail-setting is better, take that. No matter what course we pursue, let it be uniform. Then, when we gather the cream, if it is thought better that the butter should be manufactured by one individual, take the cream to him, and let all the butter be made by one hand, and let it be made alike. If it is necessary that it should be colored, let it be colored alike. If it is necessary that it should be salted, let it be salted alike. It should be of uniform consistency and quality.

Now, if you have caught my idea, you will see at once that we could go into the market with a certain quantity of butter, and, either through private customers or in the public market, dispose of our product. We could put on the market every week a certain amount of uniform butter. Well, we know very well from past observation, that, if we could put upon the market a certain quantity of butter uniformly of the first class, we could obtain very much better results than we have heretofore been able to get. I doubt whether those ten farmers, if they would so unite, or five farmers, if they would so unite, would find their returns, whether the butter should go into the general market or not, ranging from fifteen to thirty-five cents a pound, as the price has ranged, and sometimes, even when there is a good market, less than that.

Mr. ———. I would like to ask the gentleman if he thinks that any ten of his neighbors would agree upon what breed they would have for a sire.

Mr. Barber. I think they would. As far as I understand the matter, I see no reason why ten individuals cannot unite and agree upon what they will do in the matter of dairying as well as they can unite and agree as to what they will do in manufacturing, or in regard to the building of a railroad, or in regard to the management of any corporation.

Mr. ———. It is very fortunate that we have arrived at that point where it is not necessary for ten men to unite to buy a pedigree bull, because one can be bought for thirty dollars. Any farmer can have a pure-bred bull to-day.

Mr. EVERETT (of Princeton). The gentleman who has just taken his seat has said many things that it would be well to observe, and which I should commend; but, sir, his experiments, as he has stated, have extended over only six years. Can any of us expect that the model cow which will come in the generation ahead can be obtained in that length of time? How was it in relation to beef cattle? How long were Colling and Bates, and Whitney and Fowler, and other men in England, who were the first breeders of the old-fashioned stock,—how long were they in getting the perfect animal for the slaughter? Indeed, we have not got it yet. We have the bullock pretty nearly perfect for slaughter, every part that gives the best steak and roasting pieces, and with the least waste of the poorer parts. It is almost a hundred years since they commenced breeding for the purpose of giving us a perfect animal for beef; and yet the gentleman is surprised that he has not succeeded in getting the model cow in six or seven years. The Short-horn and Hereford, which are the two best breeds for beef in this country and in Old England, have come very near to perfection as far as beef is concerned; but we have been almost a hundred years in getting these, and the time will come when the breeders of those breeds of cattle for beef will connect with them the dairy cow; and, when you get the perfect dairy cow that is a perfect model for beef also, you will have the model animal which some future generation in this country, in England, and in other civilized countries, will have. Whenever I have been called upon to say any thing upon this topic, I have enjoined upon all men who are engaged in breeding these pure-bred animals to have in view that idea,—the connection of a perfect dairy cow with a perfect animal for the shambles.

I am engaged, not so much in the dairy, though I have been in the butter business all my life upon the farm where I live and upon which I was born; but I am engaged more particularly in fattening cattle, and I want, when my cow is done for the dairy, that she should be a perfect animal for the slaughter, and I would suggest to the breeders of pure-bred stock here, whether they are interested in the Short-horn, or the Hereford, that they have yet to combine the dairy in the same animal. No one with whom I have ever conversed pretends that he has by any system of breeding

yet attained perfection in that respect. One gentleman in Fitchburg, who has now gone out of the business, I believe, (Mr. Page), told me that he had a Short-horn cow that was about perfect for milk. Her butter qualities were not yet developed fully; but for milk he thought she was as good as any cow that could be presented from any breed by any breeder, almost. But that cow is not certain to produce a perfect animal in her progeny, from the fact that thorough breeding has not been continued long enough.

Bates and Colling, as I said, commenced their experiments to produce a perfect animal for the slaughter nearly a hundred years ago; and it may take as long, I do not know but longer, to connect the two, — a perfect dairy animal and a perfect slaughter animal. That problem, gentlemen, is before you. Let all breeders of stock have that in view. Some men or set of men will make themselves famous hereafter as having accomplished that, as Bates and Colling did. Bates had no idea, when he commenced in England, ninety years ago, of breeding for the dairy. His object was to get the best animal for the English market when slaughtered. As you know, the English are notorious for their love of beefsteak and roast beef the world over. Now, let us look to that point, and let all breeders have that in view.

Mr. Ellsworth (of Barre). This subject is one of great importance. In the first place, I do not think there is any thing better for a butter cow than the Jersey; and perhaps the grade Jersey is equally good for butter. I have seen butter from full-blood Jerseys that appeared to be too heavily loaded with fat, and did not seem to be quite agreeable as to flavor; while I have seen butter made from the milk of grade Jerseys that I thought was perfect. I am aware that there are cows of mixed blood that are equally good for butter-making as the full-blood Jerseys; but they must be bred for the purpose. If I understand the object of this discussion, it is to ascertain how to breed a dairy cow, and that means a cow for milk, butter, and cheese. The ways and means will differ for the different objects. A grade Jersey is a remarkably good milker, in my experience, for milk or for cheese; and I have found that the grade Short-horn was equally good, when carefully bred. That is my stock. I have bred it wholly for the dairy, not for beef, for about

thirty years. I have some forty head, and there is not a female among them that I have not raised. I have always had a full-blood male to cross them with. In raising calves for the dairy, I do not expect to get more than two prizes in six, with two more good ones, and two blanks. I think that agrees with the experience of other people who have raised their own cows. They will take back, or something will turn up to prevent them from becoming perfect cows; but, in long breeding, we can breed closer than that, and we get a prize oftener than one in four. To do so, I always use a full-blood male and my best milkers on the female side. In that way, I can carry a type pretty nearly. Any one who should see my herd would know that they all belonged together, that they are all of one breeding.

Then comes the feeding. It is no use to think of making much out of a dairy, unless it is very well fed and nicely cared for. It takes about so much to support nature; then, if you want to make some profit, you have got to put it through the animal. The cow is a machine; and she must be very nicely fed, with a view to the special result you are seeking to obtain. A well-fed cow can be made to produce a large flow of milk for months longer than she can if she is not fed well. My plan is to feed well, and milk nearly up to calving-time, letting the cow go dry only ten or eleven weeks. A cow needs some rest to get up to a good flow, and get up to good flesh. I have found that I cannot give any better food than plenty of good, sweet, early cut hay and a small quantity of Indian meal. Dried grass is good enough to make good, rich milk, if your cow is in good order. It is not a good plan to attempt to make first-class butter if your cows are in low flesh. Feed alone will not do it. If the cows are low in flesh, the milk will be deficient in fat, if fed ever so high. To do well with butter, you must have your cows in good order.

Mr. Everett. The gentleman spoke of grade Jerseys, I think, coupled with some other animal. I would like to ask him what other breeds make the best grade cow for butter.

Mr. Ellsworth. We have had remarkably good luck with the grade Short-horn, crossed with the Jersey, — a Jersey bull and a high grade Short-horn cow.

Mr. Flint. I would like to ask Mr. Ellsworth to give

his idea as to the form, structure, what may be called the "make-up" of a dairy cow. The farmers of New England have a sort of ideal in their minds as to the form and structure; but those of us who have seen the different breeds know that some races of dairy stock, like the Swiss, for instance, are large-boned, coarse animals in some cases, and yet they have the reputation of being very good and very large milkers. Mr. Ellsworth has made very careful observations in regard to the nice points of a first-class dairy cow, and I would like to have him state to the audience what his ideal of the form and structure of a dairy cow is.

Mr. Ellsworth. I should prefer a medium sized cow, no matter of what breed. I would not have a large, overgrown one; I would not have an underling. I want to have her light forward, and run out heavy behind if possible, with a good sized barrel to carry her feed. I want to have a small, clean neck, and nice fine limbs and tail. Allusion has been made to the Swiss cows as remarkable milkers and butter-makers. The very look of them is enough for me. See the bone that it takes to carry them! I do not want that heavy-boned animal for either milk, butter, cheese, or meat. It is an overgrown, clumsy animal. I have no doubt, from the fact that I have known how much Indian meal has been fed to them where they have been making this nice butter, that a Swiss cow fed with six, eight, or ten quarts of Indian meal, will make a great deal of good butter, and she ought to, and make flesh at the same time. A cow that is fed in that way is not a good cow, if she will not make flesh. Does that answer the question?

Mr. Flint. Yes, in the main. The form of Swiss cattle, as I have seen them in this country, seems to be an anomaly, and entirely to contradict our ordinary notions of the size and structure of the dairy cow.

Mr. Ellsworth. The breeds that we have almost exclusively in Massachusetts are of medium size, small consumers, and large producers. We can afford to keep such cows; but in Massachusetts we cannot afford to keep a very heavy feeder and large-boned animal for dairy purposes. It would be foolish for me to undertake to keep those large Swiss or large Dutch cows for what I want. The kind of cows that I keep make good beef, good veal, good butter, good cheese,

and good milk; and I think that is about all we can expect from any one breed. When we step aside from that, the Jersey cow is remarkable for butter; but there is not a great deal left of her after you get through; while the other breeds are very good for milk, and they make a superior quality of butter. A great deal depends upon feeding well in making a good quality of butter.

QUESTION. What is your experience in regard to feeding cotton-seed?

Mr. ELLSWORTH. Cotton-seed, to a small extent, is very good. I should not want to feed it very high. It is very hearty and very rich food. I should want to feed some shorts and some roots with it.

Mr. CRAFTS. Would you give a cow all the hay she would eat in winter?

Mr. ELLSWORTH. I would give her all she would eat in two meals. I would not feed her oftener than twice a day; then she will have ample time to manufacture her food into milk and beef.

Mr. CRAFTS. Have you tested cows in that way?

Mr. ELLSWORTH. Yes, sir.

Mr. FLINT. I would like to ask Mr. Ellsworth the average weight of his dairy cows, and how much meal he feeds a day, on the average.

Mr. ELLSWORTH. My cows, when I turn them for beef, will average somewhere in the vicinity of seven hundred pounds of good beef. That is about what they will weigh. I do not wish to give over two quarts of Indian meal at one feeding. I would rather give two quarts of meal twice a day than four quarts at once, and I give about two quarts of shorts and bran to a dairy cow. If I wanted to make flesh at the same time, I would not give much shorts. We differ a good deal about the amount of meal that should be fed to our cows. That depends almost wholly on the quality of hay that goes with the meal. If it is lowland hay, and not well made, if it is not sweet, you will have to put something with it to make it of the desired richness and quality; but, if the hay is what it should be to make butter or milk, two quarts of meal is enough, while the cows are in milk. I never feed any meal except when they are in milk.

Mr. SHEPARD (of Westfield). Have you had any experience in keeping Swiss stock?

Mr. ELLSWORTH. I have never kept a Swiss cow. I have been to Mr. Aldrich's, and seen his Swiss cows fed, and seen their butter; and I have heard Mrs. Aldrich say that she did not want any shorts or roots to feed her cows to make butter, she only wanted Indian meal. That is the most I know.

QUESTION. Do you consider that the Swiss cows make a good quality of butter?

Mr. ELLSWORTH. No, sir; I do not.

Mr. SEDGWICK (of West Cornwall, Conn.). What would be the average yield of milk per day, and the average amount of butter per day, from an animal fed as you have suggested?

Mr. ELLSWORTH. I don't know as I should be willing to state what the average would be; for I have never got at it. My cows come in at different times. We make butter from the whole herd. Some give a quart of milk, perhaps just drying off, and some give a good-sized mess. I don't know that I could get at that exactly to satisfy myself or the gentleman. They give as much as anybody's cows, with the same keep.

Mr. SEDGWICK. What is the average quantity of butter per animal per year? In other words, Can you give us your idea of the standard of a perfect cow?

Mr. ELLSWORTH. A cow that will make three hundred pounds of butter a year with two quarts of meal a day and good hay, I should call a good cow, — a perfect cow, as far as I know.

Mr. SEDGWICK. Will yours do it?

Mr. ELLSWORTH. I have made two hundred and ninety pounds a year per cow, from my dairy of twenty-six cows, and fatted my calves. I have never kept the record but once carefully.

Mr. SESSIONS. Do you recommend feeding shorts with meal?

Mr. ELLSWORTH. If I fed four quarts of meal, I should give some shorts. Four quarts would be pretty heavy feeding, and the shorts would lighten it up.

QUESTION. Have you had any experience with cob-meal?

Mr. ELLSWORTH. I have had a great deal of experience in that direction. I am very glad you spoke of it. That depends a great deal upon what kind of corn year we have

had to make the cob. Last season, and perhaps two or three seasons previous to this year, when corn cured nicely, and the cob was nice and clean, I would rather pay for grinding the cobs than pay for shelling the corn; but this past season has not been so favorable, and I should not want to pay for grinding the cobs. Some of us have good corn and some of us have poor corn. When the cob is yellow and mouldy, I would not have it ground. If the cob is perfectly sweet and sound, I would rather have it ground with the corn to feed to my cows; but for horses I would rather have the corn alone.

Dr. Wakefield. Many of the breeders in this State are familiar with the type of cow that Mr. Ellsworth breeds from. I would like to ask him if he has satisfied himself, so that he can give us the results of a cross of that cow with a Guernsey sire. Has he followed that, so that he is satisfied he has got a better animal than he had before?

Mr. Ellsworth. I cannot decide that. I have a full-blood male Guernsey that I am crossing with my full-blood Short-horns. The farmers in my section are satisfied that we got better results from the few first crosses made several years ago than we have ever had since; but, for my part, I have adhered very closely to a full-blood Short-horn bull and my high grade cows. The consequence is, I have bred up very close. There are none of my animals in the Herd-Book; but they are nearly pure bred. I have tried to inform myself in order to take a new step, and see if I could not bring about something that would be as satisfactory as it used to be. I have a fine cow; but she does not produce as well at the pail as her predecessors did fifteen years ago. She is full as good as to shape, as pleasant to the eye every way, and as good for butter; but I do not get the big flows I used to get. I have milked twenty-four or twenty-five quarts a day, for a number of days in succession; but my cows do not give that quantity now.

I have been making butter and cheese the last few years, but more particularly my aim has been butter. I have a notion that I ought to make two direct crosses with the Guernsey. The Guernsey is a little larger boned animal than the Jersey, but is what would suit me better. I don't care how much my cows eat. I want a good-sized cow, and intend

to raise enough to give her to eat. I have several heifers sired by a Guernsey bull,—one that is about eighteen months old: the others are about nine or ten months old. Almost all of them have the color of the bull,—light yellow and white; and the cows have given them their shape. I never had any fear that they would not be well-shaped. I have some reason to think that I have struck a good cross.

Dr. WAKEFIELD. That was my point. I wanted Mr. Ellsworth to tell the farmers of Massachusetts whether he had pursued that experiment far enough to be satisfied that he had made an improvement by that cross over what he had in other grades. If he had followed that so far as to be able to say he was satisfied, we should be satisfied he had been on the right track. If he is not satisfied, I think we must wait until he is satisfied.

Mr. ELLSWORTH. I will give you the true result, if we live to see the heifer come to the pail.

Mr. EVERETT. How do you account for the falling-off in quantity? You say you got twenty-four or twenty-five quarts a day fifteen years ago, and do not get near so much now.

Mr. ELLSWORTH. I have no opinion on that point. I simply thought I would make another direct cross. The cows that were produced by those first two crosses were remarkably superior to their ancestors. I want to try that over again, and give it a direct cross, and see what it will do. I can't tell what will be the result.

QUESTION. Is the size of your animals as large as it was twenty years ago?

Mr. ELLSWORTH. No, sir. I don't want to feed a large animal. I want a medium animal. It used to be the fashion, years ago, if there was a calf that weighed a hundred and fifty pounds, to get all the men in the neighborhood together to help weigh it. I don't want such a heavy calf.

QUESTION. Don't you attribute the fact that you do not get so much butter to the decrease in the size of your cows?

Mr. ELLSWORTH. No, sir: I don't attribute it to that. The butter is equally good, according to the amount of milk they give. The milk is equally good; but there is not much of it, and, therefore, not so much butter. I shall be surprised if I do not get good milkers from the cross I have made with my stock and the Guernsey.

Dr. WAKEFIELD. How long have you been trying that experiment?

Mr. ELLSWORTH. I have been only two years. I have no cow in milk yet, from my cross with the Guernsey.

Mr. SEDGWICK. The gentleman has stated to this Convention his idea of a good milking-cow. He has given the amount of butter per year which his cows give. He then states that his cows are not to-day giving as much milk, or making as much butter, as they did fifteen or twenty years ago, if I understood him correctly. He furthermore states, that his cows to-day are not so large as they were fifteen or twenty years ago. Now, I will ask the gentleman wherein, in his fifteen years' experience, he has bettered himself at all?

Mr. ELLSWORTH. If my past fifteen years' experience has not given me a living and some profit, I don't know that I am any better off; but, if I am any better off than I was fifteen years ago, I attribute it to my dairy, because that has been my specialty. I don't know what your question implies.

Mr. SEDGWICK. The question is, whether you have improved the dairy cow from what it was fifteen years ago.

Mr. ELLSWORTH. I have stated that I have followed it in one direction, and I have made a very fine dairy cow. I want to see if I cannot better it for the production of butter.

Mr. SEDGWICK. You have admitted that the yield of butter per cow has depreciated in fifteen years. You say you do not get as much milk, or make as much butter per animal, as you did fifteen years ago. Then I asked if you did not attribute that to the lack of size in your animal, and you said you did not.

Mr. ELLSWORTH. I don't know but you are right, sir.

Dr. WAKEFIELD. I understood Mr. Ellsworth to say that he had been trying to breed for a smaller animal. Now, I understand him to say that that smaller animal gives as good milk, and gives as much in proportion to her size, as the other. She cannot eat as much, and there is the advantage. Is that right?

Mr. ELLSWORTH. Yes, sir: that is right.

Dr. WAKEFIELD. There is a gain just where he was aiming to get it. He was aiming to get a smaller, more compact animal, that should be large in proportion to the amount of

food consumed, and produce more in proportion to its size; and he says he has got it, if I understand him right. Am I right in that position?

Mr. Ellsworth. You are perfectly.

Mr. Sessions. I do not believe, from what I have heard said to-day, and from my own experience, that it is impossible for the intelligent farmers of New England to improve their dairy stock. I believe it is a simple matter to improve it. It is not so simple a matter to breed the perfect cow; but to improve our dairy stock is a simple matter. The directions have been given by Mr. Ellsworth and by others. The point is, that "like produces like." The man who undertakes to raise the Early Rose potatoes from the old-fashioned Jackson Whites is a fool; and any man who attempts to raise a good dairy cow from poor grades is just as foolish. The common farmer has an advantage now that he did not have formerly; for, as one gentleman has said, a pure-bred male of almost any breed can be bought for thirty dollars, and by informing yourselves, and taking care in selection, you can obtain the grades you want. I do not know that I have learned any thing particular further than that. There are circumstances which we have all observed, and we have all bred in one or another way.

Now, my father and myself have been breeding pure-bred Short-horns for the last twenty odd years. The first female we had was a fine butter cow; and every thing we have on the farm has been bred from her by selection of males from abroad; and, although we have not got a perfect cow yet, I think we have got along very well indeed, and had we had control of more money, and been able to work faster, we might have accomplished still more. I believe, as I said before, that the lesson of to-day is, that every farmer should try to breed his dairy cows by breeding from like.

Question. What do you consider a perfect dairy cow?

Mr. Sessions. The perfect dairy cow is the best dairy cow you can get. That is the ideal. But, as for any ideal that we can get, men might differ. The point we want to drive at, every one of us, is, the cow that will produce the most and the best: that is the point. The farmer must decide for himself what he wants to do with the cow that he feeds. If he wants to make butter, then he must look for

butter qualities. If he wants to make cheese, then he must look for another set of characteristics. If he wants to make milk, then he must look for qualities that will produce milk. He must be governed by the circumstances of each case. In my opinion, the general run of farmers in New England should have a cow that is good at the pail, that will make butter (for most of them make butter), and that will possess such qualities as will enable the farmer, when she is past her usefulness, or nearly so, to receive as much money for her beef as it would cost him to raise or buy another.

Now, many of our milkmen about Springfield have carried on their business in this manner. They go out among the farmers, and buy new milch cows. They look out and get a good-sized animal, with good milking-qualities, feed her well, milk her one or two years; and, when it seems best, they can turn that cow for beef for as much money as will buy another one. They prefer that plan, rather than to have a cow that they cannot sell for a tenth part of the money that a milch cow will cost. That is one circumstance. There are other people, who live near large cities, and sell their milk for high prices, in whom it would be the height of foolishness to sell a good cow. They take her and wear her out, and they can afford to ignore the value of her carcass, because she has done better for them than any thing they can get. But that is not the case with the common run of farmers. I believe that the common run of farmers should look out for a good carcass in connection with good dairy qualities. That may be obtained by cross-breeding. It does not make any difference what the pedigree is. The pedigree is of no value for utility, of course; and this end, I think, can be attained by the judicious crossing of different breeds. But let every man determine what he wants, and then look for the thing that will give him what he wants. You may be sure, as I said before, that only like produces like.

Dr. WAKEFIELD. I don't suppose that we are ever going to have a perfect cow. We haven't any perfect men. I have no doubt there is to be a great improvement in the dairy cow. I believe it will be brought about only by time. In the first place, I believe that somebody, I don't know who, some wise man, — not a *perfect* man, but some wise man, — is going to make a great improvement on the butter

cow. He will, if he follows it long enough, get it up, not to perfection, but to a great improvement over what we have now. Then you will have as good a butter cow as you have any reason to expect in this world. Then somebody is going to take that butter cow, and breed from her, until you get, not only that good butter cow, but a good cheese cow. I believe that can be done. You can make the butter cow a very good one, and then you can breed her so that she will be a good cheese cow. When you have that, then there is one step farther. I have no doubt that is going to be done; but it will not be done, probably, until we are all past using it. We never shall see it; but there is going to be a cow bred that will not only be a good butter and cheese cow, but a good beef cow. That we are going to have that cow some time in the future, I have no doubt. Our posterity will see it, but we never shall. We have seen the perfect cow pictured out here; but we never expect to realize any thing except the picture. No one can describe here the perfect cow. I may have some ideas in my mind as to what a perfect cow should be; but, if you asked me to describe her, I should be as dumb, probably, as these other gentlemen were when you asked them. She may be, and probably will be, a great deal better than any conception that anybody forms in his mind at the present time. Every thing is in a state of improvement, the dairy cow among the rest; and, although I am not sanguine enough to believe that we are going to reach perfection, I believe that we shall make a great improvement in this direction.

Mr. Ely (of Holyoke). I would like to ask Mr. Sessions how many pounds of butter his best cows will produce in a year.

Mr. Sessions. I am unable to answer that question. I hope to be able, when spring comes, to tell how much they have made the past year. I have tried experiments by the week or month occasionally; but such experiments prove very little. I think a good cow ought to make at least three hundred pounds of butter a year.

Mr. Roberts (of Pittsfield). I have had some experience in breeding and handling cattle, and making milk and butter; but I am a working-man, and not a talker. I should be pleased to answer any question that may be asked, as far

as I am able. Mr. Ellsworth, in the course of his remarks, said that the Swiss cattle were remarkably hearty feeders. I don't know as I ought to talk about Swiss cattle, as I have only one that I have experimented with. I have had her two years the first day of November. I have been trying to see what she would do. She came to Maplehurst, a farm in Pittsfield, on the 30th of October, 1877. We had a Jersey at that time, and they had both come in about the same time; so that they were new milch nearly together. The two were tied side by side in the barn, with a partition between them. They were fed precisely alike until they went to pasture in the spring of 1878. If the Swiss cow had one bite more than the Jersey, she stole it. She could not get at the roots or the meal; and, if she had any more hay, she must have stolen it. I never saw any disposition in her to rob her mate. The record showed that the Swiss cow did not consume any more than the Jersey, and made a great deal more milk and butter. The Swiss weighed, when the experiment commenced, about eleven hundred pounds; the Jersey, about nine hundred and fifty. In the fall of 1878 I took another Jersey, about the same age as the Swiss cow. The Swiss cow dropped her calf about the first of August: the Jersey cow dropped her calf at nearly the same time. They were put into the stable side by side during the winter of 1878–79, and they were fed precisely alike the winter through. If the Swiss cow got one bite the most, she stole it. They had nothing to eat except what was fed them twice a day. Two meals a day is my practice, and no more. The Swiss cow gave a great deal more milk and butter than the Jersey, and did not consume any more, so far as I know. So much for the Swiss being large eaters.

QUESTION. How much more did the Swiss produce than the Jersey?

Mr. ROBERTS. I will give the record for three months. February, 1878, the Swiss cow made fifty-five pounds of butter; the Jersey, forty-five. February, 1879, the Swiss made fifty-seven pounds; the Jersey, forty-five. March, 1879, the Swiss made sixty-seven; the Jersey, fifty-two.

QUESTION. What was the feed?

Mr. ROBERTS. The feed was as good hay as can be produced, some corn-fodder, roots, and corn-meal.

QUESTION. How did the quality of the butter compare?

Mr. ROBERTS. We have had the butter tested by a hundred people; and, in almost every instance, they said the Swiss butter was the best.

QUESTION. How much meal to a cow?

Mr. ROBERTS. When we were running them in February and March, 1879, we fed six quarts of corn-meal a day to each cow. I wanted to see what they would produce.

QUESTION. Will you state the amount of butter this Swiss cow has made in a year?

Mr. ROBERTS. In the year 1878 she made four hundred and ninety-three pounds; in the year 1879, up to the first day of this month, five hundred and thirty-seven pounds. I think she will make six hundred and twenty pounds this year. We expect that she is the best cow in the United States: that is the judgment of a good many men.

QUESTION. Do you milk her every day in the year?

Mr. ROBERTS. In the year 1878 she did not dry at all. In the year 1879 she has been dry a hundred and eleven milkings.

Mr. HYDE. Of whose stock?

Mr. ROBERTS. H. M. Clark, Belmont, Mass., imported her. I bought her of Mr. D. G. Aldrich, Worcester.

Dr. WAKEFIELD. The gentleman has been very clear and explicit in regard to the butter. Let me ask this question, How much milk does it take to make a pound of butter, compared with the Jersey?

Mr. ROBERTS. We have Jersey cows in our herd that give richer milk than this Swiss cow. We have other Jerseys which do not give as rich milk as this Swiss cow gives. We have Jersey cows, one in particular, that will make a pound of butter from thirteen pounds of milk. We have other Jerseys that it takes twenty pounds of milk to make a pound of butter. Of the milk of this Swiss cow, it takes, on the average, fourteen pounds and thirty-eight hundredths to make a pound of butter.

QUESTION. What is her age?

Mr. ROBERTS. Seven years old the fifteenth day of last March.

Dr. WAKEFIELD. Have you ever tested her powers in making cheese after you had taken the butter out of the milk?

Mr. ROBERTS. No, sir. We do not make cheese. I don't know much about making cheese.

Dr. WAKEFIELD. Here you have, gentlemen, a specimen of a very good butter cow. If you could bring all the cows in the Commonwealth up to that standard, you would then be in a very good position to grow and breed for cheese. I think the gentleman ought to feel satisfied with that animal as a butter cow, and go on with some of these other experiments. I have no doubt they are coming. I did not know we had got so near perfection in the butter-making animal as it seems we have.

Mr. ROBERTS. I have become satisfied that a good milking-cow must eat about three per cent of her live weight daily of hay, or hay and corn-fodder cut together. Mr. Ellsworth has described a dairy cow that fills my eye. The Swiss cow is not such an animal to look at. She is a coarse, heavy-necked, heavy-bodied cow. She knocks all my theories "higher than a kite." If the Swiss breed can do any thing near what this cow does, they are the butter breed. I find, in running this cow with Jerseys, that, on an average, the Jerseys give a little richer milk, and the butter from the Jerseys is of better color. A Swiss cow fed on hay, bran, and roots, would make very white butter; whereas the Jerseys would make very good-colored butter. A Swiss cow, to make good-colored butter in winter, needs corn-meal.

Mr. ———. Observation has taught me that circumstances and conditions have a great deal to do with the characteristics of cows. Will you please to describe the arrangement of the stable in regard to light, &c., in which those cows were kept when those tests were made?

Mr. ROBERTS. So far as the arrangements for light and all those things were concerned, you could not have much poorer ones. The only sunlight that reaches our cow-stable reached it in the afternoon, on the opposite side of the stable from where the cows stood; so that very little sunlight ever struck our cows. We endeavor to make good butter, and we commence to make our butter when we plant our carrots. We plant carrots for working into the butter of young Jerseys. We grow those carrots as well as we know how, and put them into the barn to be used for this purpose; so that all the hay and all the roots that those cows have eaten has

been first-class. This butter has not been made from poor feed: it has been made from good feed. That Swiss cow weighed, the last time she was put on the scales, thirteen hundred and ten pounds. Through these two winters' experiments, she made scarcely any flesh. During the two months that she made such an amount of butter she lost flesh, both in 1877 and 1878. Later in the season, she laid on meat.

QUESTION. In your experience, does it make any difference in breeding for a perfect cow, or for a stock of dairy cows for the production of milk, whether the stable is a light, or a dark one, above ground, or in a cellar?

Mr. ROBERTS. I should not suppose it would make any difference in breeding for milk, whether the stable be light or dark, whether it be above ground or below; but I like a light stable.

Professor STOCKBRIDGE. The gentlemen who have described here the type of a milch cow claim that, of whatever breed she may be, she is fine of head and shoulder, and fine of bone throughout, and the finer, the thinner, the lighter bone an individual cow of any breed has, the better she will be as a milker. That seems to be the description. Now, the characteristics of the Swiss cattle are these: Heavy head, large horns, heavy of shoulders, coarse bones, and, when slaughtered, a large amount of offal. That is the character of Swiss cattle. Now, I want to ask Mr. Roberts this question, because he is evidently familiar with them as a breed: Is this cow of his, that has made six hundred pounds of butter in a year, a coarse specimen of the Swiss breed, or is she remarkably fine, small-boned, small-headed, thin-shouldered as a Swiss?

Mr. ROBERTS. I should say she was not of the coarsest, but inclined to the fine. She is close-built, not remarkably heavy in the shoulders; still she is a heavy cow.

QUESTION. I wish to ask Mr. Roberts what his experience has been in feeding cob-meal, if he has had any.

Mr. ROBERTS. I have had a great deal of experience in feeding cob-meal. I think corn-meal is better for most of our stock with the cob ground with the corn, provided the corn is well ripened and the cob well seasoned. I think we can all afford to grind the cob.

QUESTION. Do you give your feed cut, or uncut, wet, or dry?

Mr. ROBERTS. Good English hay we feed dry and uncut. If we have a poorer quality of hay, and want to work up corn-fodder, we mix the two together, sometimes hay, straw, and corn-fodder: and we feed this dry.

Mr. ———. I want Mr. Roberts to give his experience with other breeds of cattle. I have known him when he had the care of other herds of cattle; and, if he has any thing to say in regard to the perfect cow of other breeds, I want to hear it.

Mr. ROBERTS. I have handled nearly all the pure-breds there are, — Devons, Ayrshires, Dutch, Short-horns, Jerseys, and one Swiss. I handled one Dutch herd, and tried to make them do well. They were in a remarkably poor condition when I took hold of them. I wanted to see what they were good for; and our specialty was to be butter. We had a cheese-factory in our vicinity: and, after trying to make butter from the first of January until about the middle of May, I thought we had better give up butter-making, and patronize the cheese-factory. We did so as long as the cheese-factory run, until about the middle of September, or first of October. Then we went to making butter again. My experience was, that we could get about all the milk we had a mind to from them, if we would put food where they could get hold of it; but we could not get much butter. There are some Dutch that give rich milk, as there are some cows that give rich milk in all other breeds; but it took over forty pounds of the milk of mine to make a pound of butter.

My next experience was with a herd of grade Short-horns and Canada cattle, — some sixteen grade Short-horns, and six head of Canada cattle. You all probably know what Canada cattle are. They were very fair Canada cows. My experience during that season (the year 1871) was, that it took twenty-eight pounds of milk to make a pound of butter. These records, mind you, have been carried along through the whole year. I have been keeping these records for twenty years, wherever I have been.

My next venture was in pure-bred Short-horns, a noted herd of New England and a good herd. The average number of pounds of milk required for a pound of butter

through the year 1872 was twenty-five pounds, — perhaps a trifle over.

My next move was to take hold of a herd of grade Ayrshires and grade Jerseys; or, rather, they were supposed to be pure-bred Jerseys and pure-bred Ayrshires, and the crosses of each. When I became interested in the herds, and undertook to ferret out their pedigrees, I could not find any pedigrees: so I might as well call them grades here. There were some cross-bred animals that were half Jerseys and half Ayrshires. I wish I had my figures here, so that I could give you my first experience at Maplehurst, which was with this herd. There were some forty-four animals in the herd when I took charge of it. I think that the amount of milk it took to make a pound of butter during 1873 was about twenty-four pounds. In 1874 I prevailed upon the proprietor to sell out his herds that we could not find pedigrees for, and get a herd of pure-bred Jerseys. We did so, and started with a small herd of pure-bred Jerseys in the spring of 1875. They were mostly young animals. The amount of milk required for a pound of butter has varied from eighteen to twenty-one pounds in this herd of Jerseys. I am speaking now of thorough-bred Jersey milk.

One of the best cows I ever owned, or ever had any thing to do with, was a Devon. I considered that she was the best cow I ever handled until I took hold of this Swiss cow. I know she would make fourteen pounds of butter a week, week in and week out, for two or three months at a time. She had good feed to do it.

My first experience with Devons was rather discouraging. I went to an auction, and saw two Devon cows that filled my eye; and I bought them, paying a large price. One proved to be troubled with the garget, and the other proved to be a hard milker. I kept them a year and a half, and finally worked them into beef. My next experience with the Devon was with a grade cow that I came across near Providence. She suited my eye, and I bought her. She proved to be a remarkably good cow. I kept her between two and three years, and sold her when I left New Hampshire. Common cows sold at the same sale for from eighteen to twenty-two dollars; but she brought eighty-five dollars, wholly on her reputation. I kept track of her as long as she lived, and she was a good cow as long as she was in use.

Mr. Sedgwick. Can you give this meeting the average amount of milk per cow per annum, and the average pounds of butter per annum, for the whole herd, for a whole year?

Mr. Roberts. I can give it only from recollection. I think one year the average yield of our herd of Jerseys was two hundred and forty-nine pounds, taking them young and old together. Another year I think it was two hundred and fifty-nine pounds. I think another year it was two hundred and seventy pounds. I am giving these figures from recollection merely. I have it all on my books at home. We have some Jerseys that give eight thousand pounds of milk in a year: we have other Jerseys that do not give two thousand. The average I cannot tell you from recollection. We have Jerseys in our herd whose milk we have set by itself thirty days, — several of them, — and they have run all the way from thirty-five pounds to sixty-two. I often set a Jersey cow's milk a week, and reset the milk of some cows the same week every year. For instance, I set a particular cow's milk the first week in November. Others I test when I think they are in their best condition, and then again, when I think they are in their poorest condition. I have tested two-year-old heifers that have made ten pounds and a half a week; I have tested heifers that were but eighteen months old, that made nine pounds a week; and so it goes from one amount to another.

Mr. Waterman (of Williamstown). I am a farmer on a small scale, and I will state to you very briefly my experience with cows in making butter. In 1874 I had a cow that was half Jersey and half Short-horn. The Short-horn was brought from Mr. Thorne's stock on the Hudson River. This cow made, within eleven months, five hundred and twenty-eight pounds and three ounces of butter, and furnished the milk for a family of from six to eight persons during the year. I have a cow now that is from the same stock, a half-sister, which, when three and four years old, made four hundred and six pounds and six ounces of butter, and furnished milk for the same family, from the sixteenth day of September, 1875, to the sixteenth day of September, 1876. As far as my experience goes, I am satisfied that a cross of a full-blooded Jersey on the male side with the Durham, is the best cross we can get for milk and for butter.

This first cow gave about thirty-eight pounds of milk a day during the best of the season. The cow that I have now gives forty pounds a day in the best of the season. The most butter that she has ever made in one week was sixteen pounds and a half a year ago next March. The first one, in sixty days, made one hundred and twenty pounds and a half of butter, and sixty quarts of milk were saved out.

I bred carefully from this first cow, from a full-blooded Jersey, and got a full-blooded Jersey heifer, that, when twenty months old, produced nine pounds of butter in a week; but she has never proved since to be as good as her mother. This Jersey bull was imported by Mr. Aldrich, and these two cows were from that stock, and were both crossed with the Short-horn.

QUESTION. Can the gentleman say how much milk the family used per day?

Mr. WATERMAN. We never use less than one quart, and sometimes more. I think the first cow to which I have referred, that made five hundred and twenty-eight pounds in eleven months, would have made six hundred and twenty pounds in the year, if all her milk had been used, allowing ten quarts of milk to a pound of butter.

QUESTION. What feed did you give?

Mr. WATERMAN. My feed was the best of the second crop of hay, always cut in the month of August, and cured the best that it can be cured. To the first cow I fed six quarts of fine feed a day during the time she was in the barn, and in the summer a little less. The second one, I gave three quarts of fine feed, and two quarts of Indian meal. The butter made by the first cow was very highly colored, so much so, you would think it had been colored artificially. The butter of the second cow was improved in color by feeding Indian meal.

Mr. EVERETT. We have heard to-day of two of the most remarkable cows that I have ever known, and I never expected to hear such reports from any living man as we have heard to-day. Now, if the Oakes cow could produce over five hundred pounds of butter in a year, and if one gentleman here has had, within two or three years, a cow that would produce over six hundred pounds a year, and another thinks that his cow would have produced over six hundred

pounds, what may we not hope may be produced in the future? I believe, as Dr. Wakefield has said, that the time will come, when, in New England even, the cows will average four hundred pounds of butter a year. I believe it can be done. If the Oakes cow, and these other cows that have been mentioned, have done it, why may not the race of cows do it, when we have bred cattle for that purpose, as Colling, Bates, and others, bred them for beef? And then, as Dr.. Wakefield has said, we can go on improving our animals; and ultimately the time will come when we shall have the perfect beef animal, the perfect milk animal, and the perfect butter animal combined in one.

Mr. J. D. W. French (of North Andover). Mr. Chairman, we should not confound characteristics of breed with signs of quality. The Swiss cows have been bred for a long series of years for the dairy; and yet they have large bones, heavy shoulders, thick necks, large heads and horns. These are characteristics of the breed, and not signs of quality. If these same points were seen in the Ayrshire, Jersey, and Short-horn, they would indicate bad quality, as it is well known they are not characteristics of these breeds. How can we account for these peculiar characteristics of the Swiss dairy breed? The answer is simply this: The Swiss breed comes from a mountainous country, where, during the pasturage season, the cows must find their subsistence on the steep mountain-sides: consequently, they must have larger bones, and be of a stronger structure, than breeds raised upon the plains. It is to be supposed that the Swiss cattle in this country will, after a few generations, begin to change somewhat their characteristics, and conform more in shape to the typical dairy cow. Indeed, Mr. Roberts has already stated that his Swiss cow raised in this country was not of a remarkably heavy structure, and was less heavy in build than many others of the breed.

Adjourned to two o'clock.

Afternoon Session.

The Chairman called the meeting to order at two o'clock, and introduced Capt. H. E. Alvord of Easthampton, who read the following paper: —

THE DAIRY INTERESTS OF MASSACHUSETTS.

BY HENRY E. ALVORD OF EASTHAMPTON.

For many generations the agriculture of England has been the model for all peoples. Regarded as one of the most important interests of the kingdom, it has been fostered by the government, patronized by the nobility, promoted by the researches and aid of the foremost scientists, and, favored by all classes, brought to a systematic and productive condition well-nigh approaching the perfection of farming. No Englishman of rank or wealth has felt his position quite satisfactory, unless he was the owner and cultivator of agricultural land; and the tenant-farmers of Great Britain have, as a class, been among the most prosperous and contented people of the realm.

But now the farming and farmers of England are in a state of the utmost depression. Over all British agriculture there hangs a gloom which is deepening every day. Parliament has discussed the subject at length as one of the most serious import; the English journals devote columns to its consideration; the relation of landlord and tenant has become unsettled; the whole great interest is demoralized. A royal commission has been charged with the investigation of the trouble, and its members are seeking information in all the food-producing countries of the globe.

As it now appears, the whole difficulty (serious enough, but very simple) is just this: American farmers are able to sell bread and meat to the English people, in their own markets, cheaper than British farmers can.

The splendid farms of Great Britain, with their choice stock, perfection of cultivation, and practically scientific management, but over-taxed and rent-ridden, cannot compete with the cheap, broad acres, and virgin soil of new countries.

The English farmer stoutly resisted the first attempts to supply his countrymen with wheat from foreign lands, but soon yielded that ground. Then he felt sure, that, even when he bought our corn to make it, his beef could never be undersold. To his dismay, the last two years have dispelled that idea. Then he turned to dairying. No cheese could

ever replace the English Cheshires and Cheddars: the people must have fresh butter and milk. Alas for human pride and expectation! The honest English judges at the recent British Dairy Show in London declared, that, "without exception, the American cheese is better than ours;" and the foremost authority in the kingdom, in referring to it, wrote, "A few years ago, no one thought for a moment that we had any thing to fear from the quality, whatever we might have from the volume, of American competition in cheese; but now we are beaten all along the line."

Still the British dairymen keep up their courage better than their fellow-farmers. Neither American nor Continental butter is up to the English standard; the milk-trade is improving; and the shrewdest observers predict that dairying will yet prove to be the sheet-anchor of British agriculture.

As far as can be seen, the suffering of the farmer-cousins across the water is caused by the competition of cheaper, newer land. Now, just as English agriculture is affected by that of America, so is the farming of New England by that of what we call "the Great West."

Examine the markets of any of your large towns, and see what you find. The flour is from the wheat of Minnesota and Missouri. You can rarely find New-England corn for sale; and many of our farmers now depend largely for feeding their stock upon the grain of Indiana and Illinois. The beef bred upon the plains of Texas or the parks of Colorado was fatted upon the banks of the Mississippi, and perhaps dressed in Chicago. The pork, hams, lard, are all from the great corn-growing prairie States. Even the mutton is now largely brought from Nebraska, the poultry from Ohio and Michigan. The cheese from Wisconsin is pushing aside, not only our own, but the cheese of New York and Vermont. What can be found produced by the farmers of Massachusetts? Butter, vegetables, and fruit; little else comparatively, and not all of these, by any means. Fruit and vegetables from a distance compete with those raised at home; and, at any rate, all cannot do truck-farming: we know well enough how easy it is to overdo that business. Butter from far distant Iowa sells for the highest price in quantity in the Boston market, and is received there weekly ton upon ton. Milk must, generally, be produced near the

place of its consumption; let us be duly thankful. But, although our home markets are more or less supplied with these articles from without the State, the value of the milk and butter sold by Massachusetts farmers far exceeds that of any other article of food produced by them. Farmers of Massachusetts, bow down to Queen Cow!

As of Old England, so of New England. Dairy farming will prove to be the sheet-anchor of agriculture in this section and in this Commonwealth.

Let us examine, with some care, the dairy interests of Massachusetts and the prospects of dairying in this State. The following table (I.) has been compiled to show the relative value of dairy products (milk, butter, and cheese, sold and used) to the other agricultural products of the State.

TABLE I. — *The Agricultural Products of Massachusetts, from the State Census of 1875.*

Dairy products (number of cows 126,034)		
Milk,[1] 35,698,159 gals.	$5,939,141	
Butter, 7,922,431 lbs.	2,747,878	
Cheese, 3,067,017 lbs.	405,293	
		$9,092,312
Hay of all kinds	. . . .	10,660,268
Animal products other than dairy	. . . .	3,934,748
Potatoes	$2,349,815	
All other vegetables	2,450,692	
		4,800,507
Apples	$1,450,252	
All other fruits	736,980	
		2,187,232
Corn	$1,006,384	
All other grain	680,310	
		1,686,694
Tobacco	. . . .	1,032,262
Manures	. . . .	2,321,373
All other agricultural products	. . . .	1,881,470
Total value	. . . .	$37,596,866

[1] Whatever errors there be in counting milk, the value of which is also given as butter and cheese produced from same, is offset by products of 22,361 cows "not on farms," which must be at least $1,200,000.

The hay-crop, which is so largely tributary to the dairy itself, is the only division which exceeds the dairy in value, and no other approaches it. Next in value stand the animal products (other than dairy), and the root and vegetable crop; but neither of these amounts to as much as the milk sold and used, and together they do not equal the dairy. The butter made annually in the State is worth more than the potato-crop, and more than all the other roots and vegetables combined: it also exceeds in value all the fruits produced, large and small, and all the grains. The milk sold and used is worth twice as much as all the butter and cheese made, and they are worth three times as much as the tobacco-crop. Excepting hay,[1] the dairy products exceed in value all the products of the soil; and they form one-fourth of the total agricultural production of the State. These being the facts as to the yearly production, the relative investment is about the same. The milch cows on farms are worth more than the horses, and are more than one-third of all the domestic animals in value. Their value greatly exceeds that of all the fruit-bearing trees, shrubs, plants, and vines in the State.

On numerous occasions within the past year, the attention of the public has been called to the rapid growth of dairying in America, and to the fact that it stands now as the first agricultural interest in the country. This State is not generally rated as agricultural, and certainly not as a dairying State; yet the facts and figures here given prove conclusively that the dairy interest, in amount of investment and value of annual products, is foremost in the agriculture of Massachusetts. We seem to be fully justified, therefore, in having this special "dairy day."

The relative importance of this branch of agriculture has greatly changed during the last thirty years, and the products have increased steadily in quantity and value: at no time have they been so great as now. This has occurred without any material change in the number of cows kept in the State, which shows a constant improvement in the quality of the stock. There were about a hundred and fifty thousand cows in Massachusetts in 1845, and there are just about that number now; meanwhile there has at no time been less than a hundred and forty thousand. Of these,

[1] Forest products, wood for fuel, lumber, &c., are also excepted.

about a hundred and thirty thousand are upon farms, and twenty thousand kept by owners in towns and cities. But the population of the State has doubled in thirty years; so that, while there was then one cow to every six persons, there is now only one to every twelve. There has been slight change in the quantity of butter made year after year in the whole State; but cheese-making has very rapidly diminished, and the production of milk for sale as rapidly increased.

(The United States Census of 1870, and the State Census of 1875, form the basis of the computations here made. There is little else to rely upon; but these are very unsatisfactory, and especially so the dairy returns in the State Census. There is no particular reason to doubt the accuracy of the figures for population; and probably the number of cows given is about right; yet I have found a mistake of a thousand cows in a single town; and this carried through all the footings. The returns of the grain, vegetable, and fruit crops, should be substantially accurate: so ought to be those of the quantity of butter and cheese made; but in one town two large cheese-factories were entered twice, making an error in one place of over three hundred thousand pounds of cheese. As to the milk product, the figures are quite unreliable: some, evidently, have returned the whole yield of milk; others, that used for food, and sold; others, only that sold. It is impossible to enumerate here the inexcusable discrepancies which occur under this head. The claim of the volume, that the milk product reported represents the total yield in the State, is simply absurd; that would make the average product eleven hundred and thirty-two quarts a year for each cow. At that rate, it would require the whole milk of more than half the cows in the State to make the butter stated, and the rest would not supply milk enough for our cities alone. Let us hope for better work on the next census. The only course now is to verify the number of cows given in the census by the assessors' returns, and then, from observation and inquiry, estimate their annual products.)

At the present time, the cows in Massachusetts appear to yield about sixteen hundred quarts of milk a year, equivalent to a hundred and thirty-three pounds of butter to each. This average is far from what it might be; but it is a better

showing than either New York or Vermont, both reckoned as dairy States. It now requires nearly ninety thousand cows to supply the people of this Commonwealth with the milk they use as milk: this allows eighty quarts a year to every person, — a very moderate estimate. Repeated experiments on a large scale have proved that in handling milk, changing it from vessel to vessel, measuring and using it, there is an average loss of one-eighth of the whole: so this would leave for actual use less than a quart a day for every five persons. This is an estimate, of course; but it results in a quantity of milk (thirty-six million gallons) very closely approaching that reported as the total milk product in the State Census. (See Table I.) We know that more or less milk is brought into the eastern part of the State for sale in our cities; but this is offset by a daily shipment of ten thousand quarts of milk to New York from various points in Berkshire County. The regions of greatest milk production for sale are naturally those nearest the large cities. In proportion to the number of cows kept, the most milk for sale is produced in Middlesex County, and next come Norfolk, Bristol, and Plymouth.

Twenty-five and thirty years ago, there was made annually in the State over seven million pounds of cheese, being more than was then needed for home consumption. Now, less than three million pounds are made yearly; while the people of the State use at least double that quantity. A large part of the Massachusetts cheese is, I fear, of what is called the "white-oak" variety, or skim-milk; so that probably the entire milk product of not more than three thousand cows should now be reckoned as made into cheese. More than half the cheese product of the State is reported by Worcester County, and in Worcester and Berkshire together seven-eighths of it is made.

There remain just about sixty thousand cows in the State as butter-makers, producing annually eight million pounds of butter: this agrees with the census. The counties of Worcester, Franklin, and Berkshire, are, in this order, those of largest production: these three report more than half of all the butter made in the State; and the five western counties give fully three-quarters of the whole eight million pounds. But the people of Massachusetts consume four

times as much butter as this every year, or from thirty to thirty-five million pounds, an average of eighteen or nineteen pounds per annum for every person. This is more likely to be below the fact than above it. Americans are the greatest butter-eaters in the world, consuming nearly twice as much as any other people. The general average for the whole country is fifteen or sixteen pounds a year. A very careful computation, made a year ago, led me to the conclusion that the people of Franklin County average twenty-three pounds of butter consumed annually. It seems fair, then, to place the average for the State at eighteen or nineteen pounds.

In preparing an article for market, the first inquiry should be as to the demand. It would be worse than useless to advocate greater attention to dairying in Massachusetts, and an increased product, unless there was a demand to supply. But it will be seen from the facts already stated, that, if the yearly product of the cows now kept in the State could be doubled, the milk and butter so produced would yet be less than the annual wants of our population. Besides, these wants are increasing year by year, especially the demand for milk as an article of food; so that it is practically impossible for the farmers of Massachusetts to make their product of milk and butter sufficient for the present and prospective supply of their own State.

TABLE II. — *Yearly Receipts of Butter and Cheese in Boston Produce Market.*[1]

YEARS.	Butter, Packages.	Cheese, Boxes.
1874	521,925	–
1875	533,318	–
1876	544,301	136,552
1877	567,635	166,262
1878	650,238	204,270
1879	750,000	230,000

But, beyond this, the demand which exists is by no means limited to the daily wants of the people of the State. The

[1] December estimated. Of the packages of butter, about one-tenth are boxes, eight to twelve pounds each. Butter packages, aside from boxes, may be averaged at fifty pounds each. Boxes of cheese average fifty-eight pounds in weight.

city of Boston has an extensive produce trade, and it is growing fast. For several years there has been received at that market alone from twenty to thirty million pounds of butter annually (this year it will probably reach thirty-five million pounds), and also about thirteen million pounds of cheese. If we suppose that half the butter used in the State passes through the Boston market (although it is not likely that so large a part does), we then have seventeen million pounds used without affecting that market, and a demand for at least thirty-three million pounds there. It is safe to say, therefore, that, in round numbers, fifty million pounds of butter are required to supply the yearly demand in Massachusetts, and fifteen million pounds of cheese. It may be asked, how the surplus of fifteen million pounds of butter and eight million pounds of cheese over and above the needs of the people is disposed of. It is sold to other States, and sent over the sea to other countries. Butter and cheese are purchased in Boston for consumption in New Hampshire and Rhode Island, also some in Connecticut, and some in Maine. From all our principal North-Atlantic ports, the exports of dairy products to foreign countries are becoming very large. This branch of the commerce of Boston has been growing rapidly. Five years ago there was exported from Boston about half a million pounds of butter and about the same weight of cheese; last year, the quantities were about five times as great; and this year the butter will exceed six million pounds, and of cheese, four million pounds. The largest shipments are made to the West Indies, Brazil, the South of Africa, Australia, Newfoundland, Nova Scotia, and England.

TABLE III. — *Yearly Export Trade of Butter and Cheese in Boston.*[1]

YEARS.	Butter, Packages.	Cheese, Boxes.
1874	10,020	–
1875	10,335	–
1876	25,769	17,855
1877	28,462	46,270
1878	43,831	58,353
1879	120,000	80,000

[1] November and December estimated. Official reports to Nov. 1: butter, 5,710,000 pounds; cheese, 3,404,000 pounds. For weights, reckon both butter and cheese at fifty pounds per package or box.

In summing up this part of the subject, it is found that the people of Massachusetts, and the domestic and foreign trade of her chief city, create an annual market for these dairy products: —

Forty-five million gallons of milk (the milk of ninety thousand cows) for use as food, fifty million pounds of butter (the product of more than three hundred thousand cows), and fifteen million pounds of cheese.

The milk-trade is easily supplied by the stock now on our farms and in our cities and towns. But, to produce this quantity of butter, there would have to be six times as many butter-making cows kept in the State as there are now, and they would have to be of better quality.

The sum and substance of all this is, that it is simply impossible to make more butter in this State than its markets annually require.

Our farmers need, therefore, have no fear of an over-production of butter, always provided the article be of the kind and quality the market demands.

The question which remains is: Can the farmers of Massachusetts do more towards supplying this great demand, especially that for butter? Can they make and sell more butter in their own markets at a profit to themselves?

The passing year has certainly been one of discouragement; but it has been exceptional. Dairy products have ruled lower in price than for thirty years; and, in many parts of the country, dairymen have realized at times but a cent a quart for milk. But within a few weeks butter and cheese have more than doubled in price, and new courage should be taken for the future. The export trade has been the chief cause of this improvement, and will probably continue to act henceforth as a sort of safety-valve upon the business. When dairy products accumulate, and fall below certain rates, they at once become available for shipment to foreign markets; the exporters clear out the stock on hand, the demand increases, and prices advance. But when prices rise above a certain point, unless there is unusual scarcity abroad, exportation becomes unprofitable, and ceases. Then there becomes a surplus in the home market, especially of the lower grades, and prices fall. The prices lately ruling have checked exports for the time being; and, as it is the season

of least production, accumulation is not much feared: so a pretty steady market may be expected for the winter. But as the supply increases in the spring, and the markets fill up, prices must drop again, until exporters can buy with profit. There is no reason, however, for expecting such an extreme fluctuation next year as has occurred during the present one.

Upon examining our markets, it is found that Massachusetts butter has to compete chiefly with that made in Vermont, New York, and the West. In order to meet such competition successfully, the requirements are (1) that our butter shall be of such quality as to command the highest price; (2) that it shall be placed in market in as good condition as any; and (3) that its cost of production shall be such as to enable us to sell at the ruling rates with profit. It is unfortunately true, that at the present time, and for months past, our butter-makers, as a general rule, have been behind their competitors on all these points. Butter has been produced at less cost than ours in Northern New York and in the North-western States, has been transported from those places cheaper, and placed in Boston in better condition, than our own home-made article, and in the market has been pronounced better in quality, and sold for higher prices. Manifestly, these conditions must be reversed; and the way to do it demands our immediate consideration.

First, how shall the cost of production be reduced? The surest and best way is to get more and better milk from the same number of cows with but slight additional cost for keeping. Keep better cows. There are too many poor cows all over the State, hundreds, if not thousands of them, that don't pay for their keeping, and many more that yield no profit. Few farmers know with sufficient accuracy what their several cows yield. If those who have never tried it will keep a record of every cow's products, and some account of the differences in cost of keeping, they will be astonished at the difference in value of the cows they keep. The simplest way to keep a record is by weighing. Once a month is better than nothing, once a week still better, giving a pretty good idea of what the animal is doing; but, to know exactly what your cows are worth to you, every milking should be weighed. This seems like a big piece of additional work; but once arranged for and begun, it will be found a

very short and simple task, and one which pays as well as it does for a merchant to keep his books. Divide the pounds of milk by two and one-sixth, and the quantity is reduced, with sufficient accuracy, to standard quarts. Few cows yield any profit that do not give over four thousand pounds, or upwards of eighteen hundred quarts of milk, in the year. This is twelve per cent more than the average in this State; and as there are many cows that do better than this, so there must be still more that do less, and that are, therefore, kept at an actual loss. There is no question of the fact that better cows can be obtained: indeed, one need not go far to find them. The Waushakum herd of thirteen Ayrshires, of whose products there has been a daily record for eight years, has an average annual milk-yield of twenty-five hundred and fifteen quarts per cow; and a three-years' trial of the Miles' herd of eleven cows of the same breed gave an annual average of twenty-five hundred and eighty-seven quarts apiece. For Jerseys, the Haskell herd of seven cows, in Franklin County, in a six-years' record averaged twenty-three hundred and twenty-five quarts of milk and three hundred and seven pounds of butter per year to each cow. The Maplehurst herd in Berkshire, ten cows, for five years has an average record of twenty-five hundred and thirteen quarts of milk and two hundred and fifty-four pounds of butter; and the Deerfoot herd in Worcester, twenty-five cows, with five-years' record, gives twenty-two hundred and fifty-two quarts of milk and two hundred and sixty-nine pounds of butter.

These were all choice stock, to be sure; but such are rapidly coming within reach of all. Grades do about as well at the pail. The Sturtevant brothers kept the daily record of thirty-three native cows for three years at South Framingham, and, although the average was twenty hundred and eighty quarts a year, concluded they could not afford to feed such poor animals. (Yet these cows gave a yearly return of fifteen dollars a head above the average for the State.) Dr. Wakefield, several years ago, reported that forty cows kept by him at the State farm, averaged twenty-one hundred and ninety quarts a year, and Superintendent Bradford has sent me the record of the herd at Monson for five years, which shows the average of fifty-one cows (about one-fourth of Ayrshire blood) to be twenty-one hundred and forty-eight

quarts a year. Out at Syracuse, N.Y., a milk association receives the total product of sixteen hundred cows; and their record for three years shows an average annual yield of twenty-three hundred and eighty quarts per cow; one owner of ten cows averaged thirty-seven hundred and sixty-six quarts per cow, and another obtained thirty-three hundred and thirty-nine quarts apiece from forty cows kept in one herd. These animals were of all races, breeds and mixtures. Such cows are worth having, and the beauty of it is we can all have them. And it is not necessary to buy. It is safer and better for farmers to raise their own milch cows, on butter-making farms particularly. Judicious breeding, raising the heifer calves of the best cows only, and weeding out the old ones, will change the entire herd in a few years.

One of the most common mistakes made is that of keeping cows till too old. Few can be economically kept after eight years of age. Old animals increase the average cost of keeping the herd, decrease the average butter product, and injure the quality. The English dairy farmers understand this matter well, and it is a rare thing to find milch cows in their herds over eight years old. It may be said that this is only a theory for improving milking-stock. On the contrary, it is a most practical method, which every man can pursue who keeps one or more cows, and has facilities for raising a calf; and it renders certain a steady improvement in the quality and value of the cattle, without any considerable outlay.

Here is an example. In 1845 a man commenced dairy-farming upon the Schohariekill in Greene County, New York. He was not a farmer, but, on the contrary, had been a tanner in that same county for twenty years. Having cleared the land of its hemlock, he found it formed a fine sod: so, when his tannery was closed for lack of bark, he stocked his land with milch cows, and began to make butter. For ten years he followed the beaten track, obtaining about a hundred and twenty-five pounds of butter a year from each of his fifty cows. Then it occurred to him that this was not enough; and he proceeded to systematically improve his herd by just the methods above recommended, keeping an exact account with each cow, and of his whole farming operations. He had only the common "native" stock of the country; and the

record of the herd begins with 1856, and ends with 1863. He kept up the number of fifty cows; and the main point is the steady increase in their average product year after year: —

Years . .	1856	1857	1858	1859	1860	1861	1862	1863
Pounds butter per cow .	125	136	161	166	183	217	223	225

In eight years he had entirely changed his animals, although keeping the same stock, improving by good management and without expense. The result was an increased product of a hundred pounds of butter a year to each cow, three-quarters of which he reckoned clear gain. It was a most common-sense, practical, business-like operation. Any farmer can do the like.

On a high bluff overlooking the village of Prattsville and the farm where this work was done, the profile of Col. Zadock Pratt stands out in bold relief, cut on the solid rock, — a fitting monument to one of the first men who systematically undertook, in an inexpensive way, the improvement of the common milch stock of America, and left an authentic record of his doings as a guide and encouragement to others.

Some men feel satisfied, if, on keeping a record of the product of the whole herd, it shows a good annual average per cow. But the knowledge of what each animal does for its owner is far more valuable than the herd average; the main object of record being to show up the non-paying cows, that they may be weeded out. A very common mistake is made in dividing the gross product of the herd by the average number of cows in milk, instead of the whole number kept. It should be remembered that every cow has to be fed twelve months in the year, and every twelve months lessens her period of usefulness by a year: therefore what is wanted is not what the animal yields while in milk, but what she produces during every calendar year.

Still further: as to a record, milk-production alone is not sufficient; quality, as well as quantity, must be considered in the question of profit, especially if butter-making be the object. The only sure way is to test the milk of every cow

separately, often enough to determine its butter-making capacity. For this purpose the cream-gauge is insufficient. There is no fixed relation between the percentage of cream from a certain cow's milk and the percentage of butter. Cows differ as much in their cream as in their milk. The weighed butter is the test. But if, by the record, you know how much milk a cow gives each month, and once a month ascertain how many pounds of her milk are required to make a pound of butter, you have a correct guide to the value of the animal.

Cheese-tests are simpler, because the ratio of the cheese-product to the milk-yield differs much less with different cows.

The first cost of dairy products may be reduced in other ways besides improving the cattle, and increasing the returns of each cow. There is, in most cases, ample opportunity for greater economy in the method and processes of manufacture and in the apparatus used.

There is more activity in providing mechanical aids for the dairy than in any other branch of agriculture. The inventions in this line are almost innumerable, and the progress made is very marked. Of the new dairy appliances, many are of little value; but there is so much of merit among them that they deserve the careful attention of every farmer alive to his own interests. It is impossible to enter upon the subject of dairy implements and machinery here; but the excellent and varied exhibition in the hall below is a sufficient illustration of what has already been said. For this we are indebted to the enterprise and public spirit of the owners and agents of the apparatus; and they certainly deserve our thanks for the interest which is added to this occasion by their admirable display. No one who owns a cow can afford to neglect such an opportunity for information as to the new theories and practices in dairy management, the handling of milk, and its conversion into butter and cheese.

The next question, in meeting competition from the North and West, is in regard to transportation, — the condition in which products are placed in market, butter especially, as well as the cost of getting them there.

Transportation is expensive, and increases the cost of any

article. As a rule, it is supposed, that, the nearer the producer lives to the market, the greater are his advantages. Certainly it should be so; but, unfortunately, this does not appear to be the fact in this section.

Upon inquiry among the Boston butter-merchants, I was told that one reason why the Western product was so much in favor, particularly during warm weather, was that it reached them in better condition, with no greater cost for freight. Surprised at this, I have visited the Boston markets on the days for receiving butter during the past summer, and personally examined the receipts from different localities. Excepting only small consignments specially packed with ice, I found that the butter from the Far West, and notably from Iowa, arrived in the best condition, as if fresh from the maker's hands. Next in condition was that from Northern New York. Vermont butter, as a whole, was unsatisfactory, although some was in fair condition. But that made in our own State, even so near as Worcester County, and more particularly shipments from west of the Connecticut River, arrived in a soft and damaged condition, decidedly lowering its grade and value. The reason for this difference is in the better facilities given by the railways to shippers over long routes. Upon further investigation, I learned that the difference in freight-rates with these extra accommodations is so slight, that the advantages are all in favor of the Western shippers. Here are some examples: The great transportation companies of Chicago own refrigerator-cars in large numbers, and send them to every section of the West to gather perishable freight, and bring it to that city. There it is classified, quickly transferred, each kind to its special car, and sent Eastward. The companies furnish the ice and all necessary attendance. A very large business of this kind is by the Star Union Line, which comes East by the Pan Handle Route, around New-York City by water, and on to Boston, partly by the Boston and Albany Road and by the National Despatch Line, which reaches Boston through Canada, by the Grand Trunk and Central Vermont Routes. Another combination includes the New-York Central, and from the Hudson uses both the Albany Road and Tunnel Line. By the Southern route around New York, butter from Illinois, Wisconsin, and Iowa, is carried twelve hundred or fifteen

hundred miles, and delivered in Boston in prime order, for seventy-five to eighty cents per hundred-weight. For butter made throughout Western Massachusetts, full half as much is charged for carrying only a hundred miles or so in common freight-cars, the shippers paying for ice if they want it. Last August I saw butter unloaded at Boston, which had been placed in a Tiffany car in Iowa, had been seven days on the road, by the Canada route. The car had not been opened the whole distance; and the butter came out as fine and fresh as when it started: the freightage, sixty cents per hundred-weight. The same train brought into Boston a load of butter from different places in Vermont, in a common car; its condition soft and unsatisfactory, and the freight rates varied eighty cents to a dollar. These two lots of butter were in equally good order at home; but, on arriving at market, the one which cost the more to get there, sold for less than the other.

Now, I have great regard for the railroads, — what could we do without them? — and we all must appreciate the accommodation and favors of several companies in connection with these meetings. But it is not pleasant to have a man pat you on the back with one hand, while he puts the other in your pocket. I believe these roads, with the great privileges and powers granted them, should be required to accommodate the people through whose lands and villages they pass, and certainly not discriminate, as they now do, in favor of far distant communities and their products. The Boston and Albany Railroad is largely owned by the State; yet the cheese-makers in Berkshire and Worcester, part owners of the road, are compelled to pay four times as much to carry a ton of their product to Boston as is paid for the same weight of Wisconsin cheese carried over the same rails. Over the Troy and Greenfield Railroad, built wholly with the people's money, winding through these Franklin hills, come loads of butter from Ohio and Michigan, Illinois and Iowa, for the Boston market, freighted from four hundred to fourteen hundred miles, for half a dollar to a dollar per hundred-weight: this gives less than ten cents for the service from the Tunnel to Boston, in superb refrigerator-cars, all expenses paid. But these Franklin-county farmers, who, within the past year, have sent three hundred and thirty

tons[1] of butter to Boston, have been charged from thirty to thirty-three cents per hundred-weight for freight, and furnished only common cars, without ice.

There is no semblance of equity in such arrangements. Of course, what has been said of dairy goods applies with more or less force to all kinds of farm-produce sent by rail to market. The farming of Massachusetts, if given a fair field, can, by good management, hold its own; but it cannot bear the competition it must meet when such advantages in transportation are given our competitors by our own roads. This injustice should receive your immediate attention. The remedy is in your own hands. The first appeal should be to the railroads. Represent your patronage of their lines through these long years and during the trying times before the great traffic was built up, and the unfairness of your present treatment. If you can secure no reduction in the freight-rates, surely so reasonable a request as that you be furnished proper cars will be at once granted. You can depend upon the Boston Produce Exchange, which has so cordially co-operated in promoting the success of this day, to second your efforts. That efficient organization joined hands with the Vermont butter-makers late last summer, and secured lines of refrigerator-cars. The Massachusetts railroads may be expected to do the same, if the case is properly presented. The farmers and merchants interested must make the effort. Should such an effort fail (though I don't believe it can), you have recourse to the General Court. We are taught that the people rule. The farmers of Massachusetts form a fair share of her people. Why should they be slow in asserting their rights? Every year we select our law-makers. Might it not be well to suggest to them that a part of the time usually spent by the Legislature in criticising and hampering our Agricultural College, and in belittling our

[1] Shipments of butter from Franklin County for five years, with prices:—

YEARS.	Pounds Shipped.	Sales.	Average.
		Cents.	Cents.
1875	511,313	20 to 45	$33\frac{1}{3}$
1876	519,671	18 to 43	32
1877	530,171	17 to 38	29
1878	584,864	12 to 35	22
1879	662,389	9 to 38	20

Board of Agriculture, might be profitably devoted to this important matter of railway transportation?

Is it not about time for the farmers of Massachusetts to suspend this apparently endless task of annually "saving the country," and one year do something to save themselves?

The remaining question in this matter of competition is even more important than the others. Unless the dairy products sent to our markets from Massachusetts farms are at least equal in quality with those which come from other sections, it is not of much use to increase the product, or to worry over transportation. A good quality of oleo-margarine is infinitely preferable to an inferior quality of butter, and can be made at half the cost. No one wants the product of bad butter increased. The more poor butter and cheese people make, the poorer are the makers, and the poorer they ought to be. But with the large proportion of well-bred cows that are to be found in this State, the abundance of good grass and good water, and the favorable climate, one certainly might expect to find Massachusetts butter, as a rule, fully as good as any other. Deplorable as it is, such is not the fact.

It is now several years since butter made within the State has stood at the head of the list in the market reports. Of course there are always a few makers, who have established a reputation for their butter, that are able to sell at prices considerably above the ruling market-rates. But the whole of this "gilt-edged" butter, as it is often called, does not amount to one per cent of the total quantity which dealers handle in large places, and is never considered in the prices stated in market reports. One day last summer I examined and priced large quantities of butter in the hands of Boston merchants. That from Western Massachusetts (and, remember, three-fourths of all the butter produced in the State is made west of the city of Worcester) was selling there at eight to fourteen cents a pound, the greater part at ten and twelve cents; and the makers generally received two cents less than these prices. Butter from Vermont and Northern New York was generally rated at twelve to fifteen cents, and dairy tubs from the Western States the same. But the products of New York and Illinois creameries sold readily at sixteen and seventeen cents, and I saw one large lot from

Iowa change hands at twenty cents a pound. All this was in bulk, — boxes and tubs, ranging in weight from eight to sixty pounds. Looking for smaller lots from special dairies, I found few consignments from this part of the State rated as high as twenty cents, and only one higher. From Vermont, a good many were placed at twenty and twenty-two cents, and some at thirty cents. Most of these lots were in lumps and prints; but the thirty-cent butter was in cubical boxes of ten pounds each, — a white, clean, attractive package, which is quite a favorite in the market. Expressing some surprise that this article stood so high, in such form, one of the best judges in Boston said to me that butter was being graded closer and closer in that market, and selling very generally on its actual merits without regard to the form in which it came. He said the demand for lump and print butter, rather than that cut from tubs, was constantly growing in the retail trade, and still faster the demand for small boxes and pails, and attractive packages from four to ten pounds' weight. He added, that, if butter was *not* first-class, extra work in putting it into prints, &c., sometimes helped its sale; but, if its quality was right, he didn't care what the form or the package was: he could always sell first-rate butter at good prices in any shape. The time to which I refer was when the prices were as low as they have been for thirty years, yet in the same stalls where I saw many Western Massachusetts boxes marked at twelve cents, there were cases of butter from single dairies — some in this State, some in Vermont — which sold at fifty, sixty, seventy-five, and eighty cents a pound, and of all these, the dealers complained that they could not get enough for their customers. One well-known dealer showed me a lot of the famous "Darlington" butter from Pennsylvania, which he sold at seventy-five cents the year round. He received a case of it every week; but his supply was never equal to the calls for it.

Later in the season, prices advanced; and, as the weather affected the butter less in transit, the difference between our home product and that from a distance was not so great. Usually in the spring and autumn, Massachusetts butter ranks nearly the same as that from the dairies of New York and Vermont, and in winter time it goes ahead of them: this is attributed by the dealers to the greater amount of grain and

·root feeding in this State. But what is gained in the winter is lost in the summer, and more too, because four pounds are sent to market in the summer months to three pounds at any other season. The Boston butter-merchants consider the summer butter sent from this section as poorer in quality than it used to be, and think this due to carelessness in making, a lack of proper facilities on the farms, and unnecessary exposure to heat between the farm and the railroad, as well as the want of suitable cars.

But, even when Massachusetts butter stands at its best in the market, New-York and Western creamery stands still higher. Taking the year through, the average price of the second grade of creamery butter — whether it be from New Hampshire or Connecticut, New York, Illinois, or Iowa — is higher than that of the best Western Massachusetts butter, and the creamery is easier to dispose of in our large markets.

This is not a pleasing condition of affairs; and it is well worth inquiry as to why it is so. Why does creamery butter stand at the top of the market, as it has done without exception for the last three years?

This raises the whole question of the relative merits of the factory or creamery system of dairying as opposed to the old method of every farm working up its own milk.

The time allotted for this paper has nearly expired, and this is a broad question, too broad to be fully considered here. I will therefore only present the leading points, leaving the rest of the subject for the discussion which is expected to follow.

The first important fact we have to meet is that creamery butter has established a reputation for uniform good quality. Here is a double merit, — a good reputation as to quality, which, once established, makes a good market for almost any thing, and uniformity in the product, an evenness of quality in large quantities from the same source, made at the same or different times. This uniformity is a great point, attractive alike to the merchant and to the consumer. For example, when a car-load of butter from the farms of Massachusetts or Vermont reaches Boston, there are usually from a thousand to fifteen hundred different boxes or packages; and every one of these has to be examined, tested, to determine its grade. Very few makers of small quantities

have such reputation for a uniform article as to have it accepted week after week, and priced without examination. But it is a very common thing for a car-load of creamery butter from the Far West to be unloaded and placed in store without opening more than half a dozen tubs in the lot. You can readily see what a great advantage this is to the receiver and to all merchants who handle it. I was present last August when an order was filled for six thousand pounds of butter, and but a single package was opened to test the quality. It was all from one well-known creamery in Iowa; and the buyer was confident that the quality was uniform throughout. No such transaction would be possible in dairy butter. It would be difficult to find so large a quantity without there being half a dozen different grades, and the buyer would certainly not feel safe until every parcel in the whole lot had been sampled, no matter where it came from. I may add that the butter I have alluded to was purchased to be sent to the south of Africa, and was made at the Diamond Creamery of H. D. Sherman & Co. in Iowa, which took the general sweepstake prize at the International Dairy Fair at New York a year ago. The sale was made at more than double the ruling price, at the time, for Western Massachusetts butter. The enterprising Boston agents of this famous creamery have placed a fine exhibit of its butter in the hall below.

Every butter-maker present knows what a difference there is in the home product at different times. Sometimes my best butter cows are dry, and sometimes at their best; now the feed is first-rate, and again it is poor; this week I'm feeling well, and take special pains with the work; last week I was half sick, very busy, and very careless; sometimes the butter "won't come," and when it does it is so soft! Is it any wonder that the butter from the same dairy differs in its appearance, its consistency, and its whole quality, week after week? With such varying circumstances upon a single farm, with eight or ten cows, just think of the variations upon a hundred separate farms. How is it possible, when such a difference exists in the stock and the owners of it, in the pastures and the water, the management and the making, for the butter from the hundred farms to have any uniformity? It *isn't* possible, and that's just what's the matter.

But now let all the milk or all the cream from the thousand or more cows on the separate farms be brought daily, or twice a day, to one place, and thoroughly mixed. You see at once how the law of average will give you a remarkable uniformity to the mass day after day, and month after month. In so large a number, there will always be just about so many cows of one kind in milk, and just so many of another, just so many fresh, and so many giving rich strippings only. But add to this uniform, methodical treatment of the milk or cream, and the butter made always in exactly the same way and by the best butter-maker that can be found on all those hundred farms, whose whole time is devoted to the work, and it becomes clearer and clearer why the butter so made is uniform in quality and of a high grade. Moreover, let the many different owners of these cows, men who have an equal interest in the result, consent to be governed by rigid rules, wisely framed, to guard against those mistakes in feeding and management of cows which so often injuriously affect the butter, and the matter of a uniform product becomes clearer still. This is the creamery system.

Several objections to it at once suggest themselves: 1. There is the additional labor necessary for carrying the milk or cream to the creamery; 2. The risk of injury and loss in the transportation; 3. The inconvenience of delivery at stated hours, which in no case can be deviated from; 4. The payment for labor at the factory which might be done at home; 5. The loss of the skim-milk, or the labor of taking it home, if the whole milk be delivered; and, 6. The surrender of some of that independence of action, and exercise of personal judgment, on the part of the farmer, which is one of the distinguishing and ennobling characteristics of the calling, and must be yielded, in some degree, by each individual to insure success for all.

Opposed to these objections are the following advantages, but a partial list at best. 1. The expense of manufacturing, including maintenance of implements and apparatus, as well as labor, is much less, in proportion, when conducted at one place and for large quantities, than for small lots at a hundred different places. 2. The tendency of this system is, unquestionably, to very greatly raise the average quality of the product, from the same cows, as well as to insure uni-

formity, already sufficiently explained. In many cases the butter and cheese produced by this method equals the best ever before produced in the same section, and at times surpasses it. If this is doubted, just see the revolution which this creamery system has wrought in the West. Under the old method of separate dairies, they had the same soil and climate, the same pasturage, practically the same cows, and the same keepers. Then Western butter was known in Eastern markets only as "grease." With the very general substitution of co-operative dairying in the West came the change; and the result is but too well known to us. Western creamery butter beats that of our Eastern dairies all along the line. Nor is this system successful only in the West: even in the famous old dairying county of Orange, New York, their factory butter now sells at the highest price. 3. The advantages in disposing of the product in large quantities, and by an expert agent, whose special duty it is to watch the markets, are as great as in the manufacture. 4. Last, but not least, is the great relief of having the milk or cream taken off the farm, saving all further labor and care. And this relief comes, as a rule, to that part of the working-force of the farm which needs it most, — the farmer's wife and daughters. Often this dairy duty is just so much in addition to the ordinary domestic cares, which are of themselves as great a burden as should be borne.

> "Man's work is from sun to sun;
> But woman's work is never done."

Relieve not only the hands of the butter-making task, but take it, by this change, entirely off the mind, and a wonderful improvement takes place in the whole household atmosphere.

Let me not be understood, however, as believing in an entire substitution of the one system for the other. Associated dairying originated in cheese-making districts, and in its earlier forms is better adapted to that branch of the industry than to butter-making. The butter-factory pure and simple succeeded the cheese-factory; and derived from both we have the later establishments known by the general name of creameries. But creameries differ much in their systems and management; and, in considering the question of introducing co-operative dairying in a given locality, the kind of

creamery adapted to its wants will depend upon various con ditions.

In Massachusetts the milk-producers near any of our large towns, where there is a steady demand for milk, butter, and cheese, can advantageously associate for the sale of their product, especially if they are already selling milk, and competing with one another. In such a case, all the milk should go to the creamery twice a day; and its manager should dispose of it in such ways as circumstances dictate. Much milk may be sold to peddlers to retail; or the concern may itself profitably deliver to families by its own wagons. Cream, skim-milk, sour milk, and buttermilk can all be sold in our cities and towns. The milk not sold may be made up into butter, cheese, and cottage-cheese, according to the market, and disposed of at wholesale and retail. Several establishments of this kind are in successful operation in different parts of the country: a part are co-operate or joint-stock concerns, and others owned by men who buy the milk outright from the producers at fixed prices. Although included in the general term of creamery, such is more properly called a dairy in its broadest sense, or a milk-association. One at Syracuse, N.Y., has for several years handled all the milk from sixteen hundred cows, at a total expense of less than a cent a quart, and has returned to its patrons about three cents for every quart received during these years of low prices.

But taking the whole milk off the farm is, in the long-run, practically selling the farm itself by the gallon or by the pound, and can only be afforded, when the receipts for the milk are so good as to enable a return to the land by the purchase of food for the stock, or of fertilizers. As a rule, selling the whole milk should not be advocated, and the butter-factory in its original form is objectionable on that account. Butter alone, however, contains no nitrogen, or other mineral matters of consequence, and may be perpetually produced and sold, without perceptibly affecting the fertility of the farm, provided the skim-milk be all used at home, and in the best way.

The kind of co-operative dairying which is best adapted to a specially butter-making section, where there is but little sale for milk at remunerative rates, seems to be that lately

introduced in Wisconsin, and which is rapidly moving eastward in its adoption. This is known as the Fairlamb Creamery System; and its chief feature is that the milk is "set" upon the farm where produced, and only the cream taken away. A uniform pattern of can is used, which shows the quantity of cream; and that is removed, and conveyed to the factory by gatherers sent out for the purpose. The cream is paid for by the inch, as measured in the can. This system has several advantages besides the one first named, 1. Of keeping the skim-milk on the farm; 2. The owner of good butter-stock gets the benefit of it in more cream sold, which is not the case where all the milk is received and paid for by the pound, without regard to quality; the tendency is, therefore, to stimulate production of rich milk; 3. The milk is set for cream when in its best butter-producing condition, that is, when fresh from the cow, — conveyance of fresh milk in a wagon, or exposure to climatic influences en route to factory, often reduces the proportionate butter-yield; 4. Every dairyman may suit himself as to the method of raising cream, using air or water, hot or cold, according to his own judgment or his home conveniences; 5. The creamery becomes a much simpler affair to conduct, having but the one article, butter, to manufacture and sell. The disposition of the buttermilk will regulate itself. Most of the general advantages of creamery practice are retained in addition to these special features.

It seems to me that this plan of associated butter-making is especially adapted to those parts of Massachusetts where the greatest quantity of butter is now made, and where the money-returns are least satisfactory. I cannot advise any to join in such an enterprise who make butter at home which has a sure sale the year round at an extra price. As before stated, there are a good many such; and the demand for butter of extra quality is so great, that many more might do the same. But, after all, this "fancy-butter" business has about it a vast deal of favoritism, prejudice, and luck, the prices often having no proper relation to the actual merits of the article; and so there is an element of uncertainty about it which people naturally shun. To the generality of country butter-makers, therefore, competing in the "gilt-edged" market is not advisable, and they should welcome any system

which tends to save care and labor, raise the quality of their produce, and increase their profits.

In conclusion, let me express the belief that no branch of agriculture has so much promise for the future in Massachusetts as dairy-farming, especially the production of butter and of milk for sale. Coupled with this as a money-crop, and at the same time directly contributing to the extension and improvement of dairying, should be the cultivation of the sugar-beet: the two may properly and profitably go together in New England, just as they do in Germany and France.

With markets at your very doors for more butter than you can possibly produce, provided it be of the best, you have your future success in your own hands. I have endeavored to point out as the improvements now most needed, better stock and better care of it (thus with closer management reducing the proportionate cost of production), more care in marketing the product, with better facilities for transportation, and the introduction of the right kind of a creamery system, that there may be greater uniformity, and a higher average quality, in Massachusetts butter.

This creamery question resembles most others in having two sides; but to me the advantages appear to outweigh the objections. Pardon the egotism; but I think that on this point half of the audience sustain me, and the "better half" at that.

The Chairman. Gentlemen, the subject is now open for discussion. The general interests of the dairy-farming of the State have been well stated, and any topics suggested by the lecture will now be in order. It is apparent, from what has been stated, that the subject is one of the most important that can engage the attention of the farmers of Massachusetts.

Mr. Everett. I would say a word or two in relation to the tub or vessel in which butter is to be packed. I have been, for the last thirty years or more, engaged somewhat in handling Vermont butter, not on a large scale, but perhaps one, two, three, or four tons a year. I got into that first from making my own butter for the Fitchburg and Clinton markets in Worcester County, where I live. My customers were pleased with my butter, and wished me to supply

them, and they would say to their neighbors, "I have my butter of Mr. Everett: I think you had better get some of him." So I got into the habit of purchasing butter from Vermont from that fact, and got to handling a considerable quantity. We in Massachusetts do not pack our butter to keep it through the fall so much as they do in New Hampshire, Vermont, and Canada. But I want to say a word in relation to the wood in which it is packed. Of all our woods, according to my experience, the heart of spruce is the best wood to pack butter in. I have found much less butter that has been kept through the season, mouldy, oily, or with other deleterious things connected with it, when packed in the heart of spruce, than when it was packed in ash or oak. Both of those woods have an acid in them which tends to sour the butter, and makes it taste of the wood. Secure, if you can, tubs made of heart of spruce. There is nothing in the smell or taste of that wood that will communicate to the butter any thing deleterious. That has been my experience. I have found four or five tubs of butter packed in ash or oak that were injured by the acid in the wood to one that was injured when packed in heart of spruce.

A word or two in relation to the coloring of butter. We have two or three articles before the public, some of which have been commended by butter-makers and agricultural papers, that I consider far inferior to that which every farmer has or may have in his own garden, or in his own cellar in the winter season. I have tried various things, and I have found nothing equal to the orange carrot for coloring butter. As I came from my home in Princeton, I took to the market in Fitchburg a parcel of butter that was churned day before yesterday, the first day of December. I would ask any man here (I would ask Austin Belknap, Nos. 1 and 2 Blackstone Street, Boston, one of the best judges of butter I know) to taste that butter or smell of it. His olfactories or yours would be full of the aroma of the butter; and it would please your taste, I am sure, just about as well as butter made in June. It can be done easily. I am surprised at the large amount of butter that is manufactured in the winter, especially in Vermont and New Hampshire, that comes to market white and insipid. Why, sir, the carrot not only does not injure the butter, but it imparts a richer flavor to it. I think

I could tell, and I think Mr. Belknap would tell you, that, if you put him into a room as dark as midnight, he could tell you which butter was colored, and which was not. You might take a quart of cream, divide it, and put one half into one churn, and the other half into the other, color one with orange carrot, and let the other come out white, and, as I said before, he could tell, in the darkest place you can imagine, simply by the taste, which of the two specimens of butter was colored with carrot. It is worth eight cents a pound more in the market than butter that is not colored. The taste is better.

Let me refer to a coloring process that has been advertised very extensively, made in Burlington by Messrs. Wells & Richardson. It is not the natural color which the grass of June will give. The carrot gives that color. If you could lift a box of June butter right over into December, you would not know, from the color or taste, the difference between that and the butter to which I have just alluded, that I carried to market. But the coloring made by Messrs. Wells & Richardson is not a natural color: it is a sort of dingy, dark color, not the lively, bright color which you have in your June and July butter. It is comparatively worthless; and I wonder that any farmer, when he has the means of coloring his butter perfectly, in his own garden, or in his own cellar during the winter, will purchase these articles, which are comparatively inferior and valueless.

Mr. Whitaker. Do you put the carrot into the cow or into the milk?

Mr. Everett. You may color your butter by giving the cow good Indian corn or good carrots, to a certain extent. I grate the carrot, and put it into warm water or milk, then strain it through a strainer, and put the liquid into my cream. But if you have cows that give milk of high quality for color, and give them corn-meal or carrots, you may get a very fair coloring without any artificial process.

Mr. Whitaker. Which would be the better way?

Mr. Everett. The best way would be to grate the carrot, I think. That has been my experience.

Mr. Sessions. We have found it difficult to graduate the coloring-matter of carrots. My butter-women have used carrots; but they found it very difficult to get the different

churnings alike. I would like to ask Mr. Everett how he does it.

Mr. Everett. That requires a little experience only. A good dairy-woman will understand very soon about how much carrot is required for so many quarts of cream. There is great difference in carrots. Some carrots are perfectly worthless for the purpose of getting coloring-matter. Get the real orange carrot. It is very easily obtained. Two grated carrots are enough for twenty pounds of butter.

Mr. Sessions. Our experience has been, that, if we buy and sow what is called orange-carrot seed, it comes up a very different kind.

Question. Do you heat your milk?

Mr. Everett. In the winter season I heat the milk, immediately after it comes from the cow, up almost to scalding heat. The milk is heated, and put away to cool as soon as possible. We heat it for two purposes. One is, that heating milk destroys the bad odor that affects the taste of the butter. Great care, we all know, must be exercised, in extracting the milk from the udder of the cow, that every thing is perfectly neat and clean. A lump falling from the cow, which may be half as big as a pea, will injure the taste of a considerable churning of butter, or a cheese. Great care, therefore, should be taken in milking, that every thing is perfectly clean, and as neat as a woman's kitchen. We scald the milk for another purpose: the butter will come quicker. The box of butter to which I alluded, which I carried to market yesterday, was only eight or nine minutes in coming. If you scald your milk immediately when taken from the udder of the cow, your butter will come a great deal quicker, and come perfectly hard and nice.

Mr. Cheever. I have but a word or two to say, and that will be upon the subject of coloring butter. Coloring butter with carrot is an old method. But all people do not like carrot in butter any better than in hash. They have a choice where they will take it; and some do not like carrot at all. Butter that is colored with carrot will taste of the carrot more or less: it is more or less offensive. The butter-coloring preparation that has been referred to is almost tasteless, almost odorless. It may be represented by the bloom on a plum, which you can rub off, which has no taste nor smell.

It is a color. It is dissolved in an alkali as simple as the alkali used in all your bread and in cooking.

I want to say one word in regard to its use, and it is for that I arose. If the best butter-coloring that was ever in the market (and I think there is none that I would rather have than Wells & Richardson's, which has been alluded to) is put into sour milk, or into any acid whatever, the color is liable to, and probably will, be changed to a reddish hue. Chemists and dyers know very well that colors can be changed very easily by a slight chemical process. This coloring, if brought into contact with sour cream, does produce a reddish tinge. If used in sweet milk exclusively, the coloring is more satisfactory to the large mass of customers than the color produced by carrots, and is as near like June butter as the best carrot-juice that can be squeezed. If you are making butter from sweet cream, you may use this coloring in the cream, and churn it. If you are using sour cream, you had better add your coloring to the butter directly afterwards. My own method of doing this I will give you. The coloring is a liquid which flows as freely as water. A drop of it will color a pailful of water. It is perfectly soluble. I simply saturate clean white pulverized sugar, that I may hold this color until I work it in. When my butter is worked from the buttermilk, and is ready for salting, I add this little amount of coloring necessary, and then work it in with the salt. When my butter is worked to an even shade, I know my salt is worked in evenly. The color then is as natural as any artificial preparation will produce.

The CHAIRMAN. Mr. Edward Burnett, the owner of the Deerfoot Farm in Southborough, one of the most famous farms for butter-making in the State, and the proprietor of the first practical centrifugal machine for separating cream from milk, is here, and I will ask him to explain to you a little about that machine.

Mr. BURNETT. Mr. Chairman and gentlemen, I am a mere boy in the business of dairying. I have been only ten years at it, and I see before me many farmers who are old enough to be my grandfathers. I have, it is true, probably the largest centrifugal machine in the world, and the only one that is being used daily in this country. The Rev. Mr. Bond of Northboro' has a small centrifugal machine below,

and you can see there how perfectly the cream is separated. I suppose he has explained to you the process.

I have had this machine since about the middle of last May. The inventor, Mr. Weston, asked me if I would like to experiment with it; and I told him Yes, and he sent it to me. It has a steel basket about thirty-two inches in diameter. This steel basket is made of forged wrought steel. The labor on this basket occupied about seventy-three days; and, at four dollars a day, you see the basket alone cost about three hundred dollars. The pressure on the outside of this basket, the machine running two thousand revolutions a minute, is two hundred pounds to the square inch. Boilers that will stand a pressure of a hundred and fifty pounds to the square inch pass the government inspection. So you see that this centrifugal force exerts an immense pressure upon the metal; and in order to put with safety twenty-five gallons of milk into the machine at a time, as I do, it has to be made very strong indeed.

This machine revolves on a spindle. It goes very much like a top. The machine is about three feet and a half from the floor; and the spindle is connected with the machine at the bottom,—sets in a box, and is driven from the bottom. The box in which it revolves of course is very finely made, surrounded with rubber, so that the machine wabbles like a top if it gets off of its centre, and sometimes it will run off the centre a little, enough to give it a wabble for two or three weeks; then the "old lady," as we call her at the farm, will straighten right up, and run as true as a die. This basket, filled with milk, revolving on this steel spindle at the rate of from fifteen hundred to two thousand revolutions a minute, forms a perfect wall of cream upon the sides. You have all probably seen a pail of water swung around a man's head, and you know that centrifugal force holds that water up. It is forced gravitation.

All gravitation tends toward the centre of the earth; but whirling a pail of water round your head produces forced gravitation, which holds the water perpendicular. This machine produces that forced gravitation, and we have a perpendicular wall of milk. The top of this basket is about thirteen inches in diameter, and the opening has a cover with a brass flange, which raises it above the top of the ma-

chine an inch or an inch and a half. This basket is filled with milk to the very edge of this opening. In one minute after it begins to revolve, I see the milk change color. It becomes less and less opaque, and assumes a sort of bluish white shade. It grows deeper and deeper in color for three or four minutes, and in from eight to ten minutes I find by experience that I have a stratum of about an inch of cream on this wall of milk.

Now, to get this cream out, we have two valves, invented by Mr. Bond, who has them here, I think, on his machine, both of which are connected with the spindle. The process is a rather difficult one to describe; and, without a blackboard, I don't know as it will do for me to attempt it. I am afraid I should get confused myself, and I am sure I should confuse you. I will simply say, that the skim-milk is let out at the rear, by means of these valves, into a great tin dish, which is about ten inches in diameter, or less in diameter than the opening at the top of the basket. This pan, I should say, is about three inches deep; and on this pan are two ears, just such as you see on an old-fashioned tin kettle, perfectly straight. These extend into the milk, pass through the wall of cream; and by means of this tin pan, dropping the milk into the centre of this machine, we bring the cream forward, until finally it is released on top. Although this is not natural, the pressure is so great that we get a forced gravitation, you know, and it is released on top, and thrown over this rim, and caught in a receptacle which surrounds the top of this basket.

That is simply the whole process. Now the object of this machine is simply to extract all the lighter fluid, or the cream, from the heavier fluid, or the milk. Winkel, in his definition of milk, describes it as a fluid in which the fats are in a state of perfect solution as the milk is drawn from the cow. Well, this cream, or oil, is separated from the skim-milk by means of this forced gravitation, this centrifugal force, so that we obtain by mechanical means, in a few minutes, what it takes Nature from six to thirty-six hours to produce. I know the practicability of the machine; for I am handling about two tons of milk daily, and run the machine from half-past six in the morning until three o'clock in the afternoon. I put up some of this cream in little pint bottles, and ship

it to Boston market, and I make from seventy-five to a hundred pounds of butter a day. This cream is of most delicious flavor; but all the globules are more or less broken. This cream sours very quickly. It will not keep unless we bottle it up immediately, and plunge it into ice and keep it at a temperature of forty degrees until it is thoroughly cold; but, when we churn the cream, we find we can drop it down to fifty degrees, and we can churn it in about half the time we could the cream I used to get from my deep pails. That is a great advantage. We used to churn our cream at a temperature of from fifty to sixty degrees in the summer. This summer we churned at from fifty to fifty-two degrees by the thermometer.

Let me say here, that I think the thermometer is the dairyman's best friend. I do not know of any thing so important in the manufacture of good butter as to get your cream at that temperature which brings your butter just right, just where you want it; and, by a little experience and practice, I maintain that a good farmer can do that every time. This cream is certainly broken more or less by the force by which it is thrown off by this machine. Whether it is injurious to the butter or not, I have been six months making up my mind, and am still a little on the fence, although I think I have got one foot over a little on the other side; but I am still in doubt. Some say that the grain of the butter is injured, and some say it is not, although I have never submitted it to so critical judges as you have had to make your awards upon the exhibition below.

I am very much in love with this machine, and I suppose I could go on and talk for an hour. I should be pleased to answer any questions. I hope I have described the machine in such a way that you understand it, and understand the process.

Mr. West. What is the milk worth after it has been through your machine?

Mr. Burnett. That is another point to which I intended to allude. My skim-milk finds a very ready market in Boston; and Thanksgiving week it brought me from two cents and a half to four cents a quart. But that was in a time of undue excitement: the market was very bare. I wholesale it now for about two cents and a half a quart.

Milk contains from eighty-eight to ninety per cent of water. A dish of water set in any room, I don't care how clean and nice it may be, will become more or less brackish, and be more or less affected by the atmosphere; and I maintain, for that reason, that this centrifugal machine produces a much better article of milk, although there is no cream in it. By actual experiment, I gain about six per cent over any other method of setting that I have tried, and I have tried them all, though not as carefully as I wish to do. I get six per cent more in butter. I find cream varies so much that I always speak of butter.

The CHAIRMAN. Won't you tell us how much cream you can get from that skim-milk by setting it from six to twenty-four hours?

MR. BURNETT. I have never seen any cream on my skim-milk after it has been through the machine.

QUESTION. At what temperature do you set your milk?

MR. BURNETT. We take the milk warm from the cow to produce the best results. By running this machine one minute more than is necessary, we get a cream that is so thick, that I could take a tumblerful, and put a spoon into the middle of it, and it will stay there for thirty seconds, until it gradually begins to cant over. Of course, after it begins to lose its equilibrium, it drops very rapidly to the side. The cream is thicker than good molasses. Let it stand two days, and it will be like a Dutch cheese. I have had butter on my table for breakfast made from cream from this centrifugal machine three-quarters of an hour after the cow was milked. The skim-milk thrown off by this machine deposits a green slime, which is found in every milk that I have ever tried, although I rather pride myself on the cleanliness with which my operations are conducted. My cows' bags are all wiped with a piece of burlap before they are milked. They are carded every day. My men are obliged to wash their hands before they go to milk, and I take all the pains possible to get the cleanest milk. It is strained through three strainers and through a cloth; and yet, in spite of all that, I find about as much green scum from my milk as from A's, B's, or C's milk. On the inside of this machine we find a green scum that is very disagreeable and offensive. It is something that changes very rapidly. The chemical

changes are so rapid, that in ten minutes after it has been exposed to the air, the odor is most offensive. What that is, and more about it, I shall be able to tell within a week, as it is in the hands of two chemists for examination.

QUESTION. Is there a continuous flow of new milk into the machine?

Mr. BURNETT. We do have almost a continuous flow. Mr. Bond has an arrangement which he has shown me to-day which I hope will produce a continuous flow. But we run the machine for five minutes without putting any milk into it; then we slow it up a little, because, when it is running at this very high rate of speed, for the safety of my dairymen I advise them to slow up before they open the valves. It is not necessary: it is only done for safety. We perhaps drop five hundred revolutions, and then we let in a continuous flow of milk. Then we run for fifteen or twenty minutes, and slow up for about five, and, while the machine is running slowly, we are running off the skim-milk. The pressure is so great on this milk, that it will fill a forty-quart can in about a minute, through those little holes, which are only a quarter of an inch in diameter. I never saw any thing like it. The amount of milk that comes through these little openings at the back of this machine is tremendous. The skim-milk is thrown off more violently than the cream. It comes out in the shape of froth; and, as you see it in the pail, it looks like the most delicious frosted milk. I put a little of it on a piece of board, and run my finger through it, which knocks the air-bubbles out of it, and then I see the finest kind of blue skim-milk. I think it has all the properties in it, except the cream or the fatty part. It has this poisonous matter that we get on the back wall of the machine taken out; and I think that skim-milk will keep longer, and is a better article for food, than ordinary skim-milk, although it does not contain as much cream.

Dr. WAKEFIELD. Have you ever set it for cheese? Do you know any thing about the curd?

Mr. BURNETT. No, sir; I have not.

Mr. CHEEVER. Does your skim-milk also need icing to be kept, as your cream does?

Mr. BURNETT. Yes. My skim-milk will keep longer than ordinary milk; but from the experience I have had

during the last two months in shipping milk to Boston, and selling to wholesale men, I find that the only safeguard is to ice my milk down to forty degrees the moment it comes from the machine, because a great deal of this milk that goes into my machine still has the animal heat in it; and with that animal heat I will not say we get a better result, but we get a more rapid result, than we do by cooling it.

Dr. WAKEFIELD. Is the skim-milk increased in heat, or diminished, by the process of churning?

Mr. BURNETT. It is diminished. The rapidity with which this machine revolves creates a tremendous current of air. As you stand by the machine and look into it, you will feel it strike your face. You will find, that, when the machine wabbles much, the current of air is tremendous. It cools the milk, I think, two or three degrees. We obtained a very good result, when we first started the machine, by filling it with milk, and then stopping it, and taking off the cream. We got immense junks of cream that we could take up with the thumb and finger and put into a vessel. It was like a piece of soft sole-leather.

QUESTION. How much power does it take to drive it?

Mr. BURNETT. This summer my dairy was run by a three-horse-power engine and boiler. It was rather difficult to start that machine with that: it required a good deal of care. This machine is so heavy, that it requires some care to start it; but, with my present fifteen-horse-power boiler and ten horse-power engine, it can be done very easily. To show how perfectly the machine I have is made, I will say that it runs eighteen minutes by the watch after the power has been taken off.

QUESTION. Have you ever tried any milk after it was twenty-four hours old?

Mr. BURNETT. Yes, sir. I buy my milk from about twenty farmers. The night's milk is always cool. It is treated for me just the same as if it were going to Boston. So that half of my milk is at least twelve hours old, and a great deal of it fifteen, sixteen, and eighteen hours old. I have run milk that was twenty-four hours old. It does not make any difference, except that it takes a little longer time.

Dr. WAKEFIELD. How long is the process of converting that cream to butter compared with the old process?

Mr. Burnett. I think we gain at least one-half in time; that is to say, where it took me, with the old New-York State barrel-churn, forty minutes to churn my cream from the deep pails, I now do it in fifteen or twenty minutes, and, as I say, with from five to ten degrees lower temperature, which I consider a great point.

Question. In the same churn?

Mr. Burnett. In the same churn.

Dr. Wakefield. Will you state the comparative time that it takes to churn deep-set milk and shallow-set milk? You have tried them both?

Mr. Burnett. Yes, sir. I think it takes just about as long to churn thick cream as it does shallow cream. There is another point which you will be, perhaps, interested in. Although I get fifty cents a quart for my cream from this machine, I think it would be as profitable for me to sell my cream that I used to get in those old-fashioned pails at twenty-five cents a quart as to sell this at fifty, because a quart of this thick, rich cream will make more than two quarts of the thin cream that I used to get by adding milk to the cream. Some of the hotels that use my cream are doing this same thing; and they say that they get a better cream by adding a quart of milk to a quart of cream than they usually get in Boston.

Dr. Wakefield. Is not that the reason why it comes so much quicker, — that you have not so much milk in the cream?

Mr. Burnett. It has less water. This cream, I take it, would not show over thirty per cent of water; whereas ordinary thin cream that you get by setting milk in deep pails contains about sixty per cent of water.

Question. How much milk does it take to make a pound of butter?

Mr. Burnett. I take nine or ten quarts of my milk to a pound of butter. My neighbors' milk runs from ten to twelve quarts, and some as high as sixteen or seventeen. I test this milk once in a while, and am very much disappointed in the results. It would not be any object for me to buy some of the dairies I am buying to-day, if it were not for the sale of my skim-milk. We have not the quality of milk in our section of country that you have up here. We

have been trying to get too many two-can cows, and a good deal of that milk is very poor. I think I would as soon have some of my shallow-set skim-milk from my herd of Jerseys and grade Jerseys.

QUESTION. How does the machine affect the color of the butter?

Mr. BURNETT. I think it does not affect the color at all. Some of my neighbors have said that my butter was of a better color made by this new process than it was when made from cream obtained by the deep setting. I fail to see it myself.

QUESTION. What is the probable expense of the machine?

Mr. BURNETT. This first machine, of course, was very expensive. As I say, the basket alone cost three hundred dollars. The whole machine cost upwards of two thousand dollars; but it was torn to pieces and built over, and was a very expensive machine. The cost of these machines will be, probably, in the neighborhood of four hundred dollars. That machine will be practicable for a two-hundred-cow dairy.

Mr. CHEEVER. If you use any coloring, how is that worked in?

Mr. BURNETT. I use a butter-coloring. I buy now some twenty other dairies, and I sell largely to hotels, and I color to suit them. I tell everybody with whom I deal that I color my butter. I use a very nice butter-coloring, and I find it is better than any preparation I have used, — the June Butter-Coloring. I think you have it here. I use a teaspoonful to a gallon of milk, and stir it in just before I churn. Most of my Jersey milk goes to Boston now in glass bottles. I run my own car to Boston at night; and I send most of my Jersey milk in bottles, which is delivered between five and ten o'clock the next morning.

Dr. WAKEFIELD. Will you state what you pay for the dairies in that vicinity?

Mr. BURNETT. I pay only one price for milk, — twenty four cents a small can, or three cents a quart.

QUESTION. How much do you get?

Mr. BURNETT. I get from eight to ten cents a quart. I use the glass bottles because lactic acid will not work on glass. I don't care how careful the dairyman may be, or

how carefully the cans are cleaned, if you let milk stand in them for three hours, and then turn it out, you will find the smell of the can very offensive. If you let your milk stand in glass for three days, you will find nothing of the sort. For that reason I have adopted glass. It is being introduced in New York very extensively, — much more extensively than in Boston. A gentleman who was here to-day told me that it is jumping into favor here. In Paris, there is one firm that is supplying something like twelve or fifteen thousand quarts a day to families, in little porcelain jars with stopples to them.

QUESTION. What price do you get for your butter?

Mr. BURNETT. I get forty-five cents a pound from my large hotel trade, and I get fifty and fifty-five cents from my retail trade.

QUESTION. What glass bottles do you use?

Mr. BURNETT. Mason's improved glass jar. Some have a glass cap and some a porcelain-lined metallic cap. Within the last ten days, I have had shipped from Philadelphia ten cases of the Glancy glass bottle, with glass screw-caps. They were offered on very favorable terms, and I bought them. I have kept lump butter in my refrigerator, by accident, six weeks, and I have put up butter for some gentlemen who are interested in this matter, and wanted to know about the keeping quality of the butter. Although the machine has been running only a few months, I am about convinced (I will not say certain, because I cannot judge of of this thing in so short a time), — I am about convinced that the keeping quality of butter made by this process is above the average. It is excellent. I think we shall find that this green scum that is thrown out of the milk is what injures a great deal of milk, cream, and butter; and by this machine we get rid of it.

QUESTION. In your opinion how large a dairy is it necessary for a man to have to make it profitable for him to get the machine and the necessary power to run it?

Mr. BURNETT. If you will tell me how many quarts of milk your cows give up in this region, I can answer that question. If you have herds that will average fifteen quarts of milk a day the year round, — we have a dairyman in Southborough who has published the statement that his dairy

of eight cows will average nearly sixteen quarts of milk a day each, — you see it would not take many such cows to run a whole creamery. But if you take an ordinary cow, that averages seven or eight quarts a day the year round, it would take about two hundred cows of that sort to make it an object to use a machine as large as mine. I think we shall centralize about this machine. This will be a pivot about which a good many farmers will be able to swing, and swing to their advantage. A dozen or half a dozen large farmers, uniting, and buying this machine, and supplying the milk, I think will be able to reduce the thing to the finest point, and produce the best results. That is my impression only, having used the machine but a few months. I consider myself a novice to-day in the use of the centrifugal machine; although I am as familiar with it and its workings, probably, as any one in this country. I think we are all, I know I am, too apt to jump at conclusions. We think we have got splendid results; we tell our neighbors; the story is published; and by and by time tells us that we are wrong. I would not give any thing for one experiment. I consider six experiments little enough: I would a good deal rather have twenty. Chemists are never satisfied with one analysis. That is the great trouble with us farmers: we are not careful enough in our statements. If I should live to be as old as many of you are here, and should ever have the good luck to drop into Greenfield, I don't want to be obliged to take back any thing I have said this afternoon. For that reason, I hope you will consider these statements as merely opinions of mine. I don't mean to state these things as facts; but such are my opinions.

Mr. Bond (of Northborough). Mr. Burnett has referred to the sediment which is found upon the machine, and stated that I had had some examination made of it. I carried to Dr. Cutter of Boston, who is an expert microscopist, some of the cream from that centrifugal machine, some of the skim-milk, and some of this deposit, and he examined them all, and reported that the cream and skim-milk were remarkably free from spores (these spores being what cause milk and cream readily to sour), and that this deposit was remarkably full of them. He concluded from that that we had discovered a very valuable process, not only of separat-

ing the cream from the milk, but of cleansing the whole thing.

A question was asked Mr. Burnett about the keeping of the cream; and he replied, as he has told me several times, that he did not think the cream that came from that machine would keep sweet quite so long as cream raised from the deep pails. I suggested to him to experiment by taking the cream directly from the machine, and closing it airtight, because the cream and the milk, although they may be entirely free from these spores, will contract them from the air, more or less. I don't know whether he has tried that experiment or not.

Mr. BURNETT. Yes, sir. My bottles stand on the same tables which hold the vessels which receive the cream. It is bottled and corked up immediately.

Mr. BOND. Suppose that to be the fact, that the cream does not keep quite so well, which would seem to be the case, it is probably owing to its being thrown from the machine, and the globules being broken up. That prepares it for churning, makes it, probably, better for making butter, but not so good for keeping. You want a machine for taking the cream off and keeping it. I am very well satisfied that a machine can be so well constructed, with a combination of the improvements which I have made, that you will be able to take the cream from the machine without breaking up the globules. The experiment has been but partially tried, not fully; but I have had the cream examined by a competent person, and his report is, that the globules are somewhat broken up, but not much, and that they strongly conglomerate, like bunches of grapes. That is some little modification from what was perceived in the cream as thrown off while the machine was in motion. Now, I have a modification in my mind of that process by which I think I shall be able to obviate the breaking-up of the globules. If I succeed in doing that, the cream will be in the same condition, except that it will be sweeter, as the cream raised in deep pails.

Dr. WAKEFIELD. I know that Dr. Ephraim Cutter has examined this matter very thoroughly in looking after these spores. We should suppose, that, if the spores were expelled from the cream, it would keep longer. I suppose, from Mr.

Bond's explanation, that the breaking-down of the globules more than counteracts the effect that is produced by eliminating those spores.

Mr. Bond. It would seem so. Quite likely it will result in the manufacture of two different machines, or of one machine which can be used in both ways, — either by throwing off the cream, or by retaining the cream until the machine is stopped, and then drawing it off.

Question. What is the expense of the small machine?

Mr. Bond. I think a machine could be made of copper, holding ten gallons, for somewhere about a hundred dollars.

The Chairman. The Committee on Butter Premiums will now present their report. The Committee were selected with great care, and are experts of the highest character. They spent three or four hours in making their awards, which must be satisfactory to you, however much individuals may be dissatisfied.

REPORT OF COMMITTEE ON BUTTER PREMIUMS.

MASSACHUSETTS SWEEPSTAKES.

For the best butter, not less than twenty pounds, made at any time and place in the State.

A. Fifty dollars cash for the best lot. Charles E. Fisk, Deerfield.

B. Thirty dollars cash for the next best lot. C. B. Merritt, Conway.

C. Twenty dollars cash for the next best lot. F. H. Hawks, Charlemont.

"DAIRY FARMING" SWEEPSTAKE.

Offered by Messrs. Cassell & Co., publishers, No. 596 Broadway, New York City.

D. Ten dollars. Professor Sheldon's new book on "Dairy Farming," for the next best lot after "C." J. C. Newhall, Conway.

"THE AMERICAN DAIRYMAN" SWEEPSTAKES.

E. One year's subscription, mailed free, for the next best lot after "D." L. F. and W. H. Gray, Ashfield.

THE THURBER MEDALS.

F. Gold medal, valued at twenty-five dollars, for the best lot. F. H. Hawks, Charlemont.

G. Silver medal, valued at ten dollars, for the next best lot. H. C. Haskell, Deerfield.

H. Bronze medal, valued at five dollars, for the next best lot. T. J. Field, Northfield.

THE SHALLOW-SETTING SPECIAL PREMIUMS.

J. Twenty-five dollars for the best lot, in goods made by the Ferguson Manufacturing Co. C. E. Fisk, Deerfield.

K. Fifteen dollars for the next best lot, in goods made by the Ferguson Manufacturing Co. C. B. Merritt, Conway.

THE DEEP-SETTING SPECIAL PREMIUMS.

L. Twenty dollars for the best lot, in goods made by the Vermont Farm Machine Co. Jonas Moore, Shelburne.

M. Ten dollars for the next best lot, in goods made by the Vermont Farm Machine Co. R. S. L. Shattuck, Greenfield.

FRANKLIN-COUNTY PREMIUMS.

N. Twelve dollars cash for the best lot. C. E. Fisk, Deerfield.

O. Eight dollars cash for the next best lot. C. B. Merritt, Conway.

P. Five dollars cash for the next best lot. F. H. Hawks, Charlemont.

PRINT BUTTER SWEEPSTAKES.

Q. Ten dollars. Professor Sheldon's new book, "Dairy Farming," offered by Cassell & Co. for the best. C. S. Sargent, Brookline.

R. "The American Dairyman" for 1880, offered by the publishers for the next best. E. Norton, Farmington, Conn.

NEW-ENGLAND SWEEPSTAKE.

S. One No. 4 (4-can) Moseley's Cabinet Creamery, for ten to twelve cows. C. E. Fisk, Deerfield.

FOR EXHIBITS OF DAIRY IMPLEMENTS.

T. Israel Childs, Sunderland.
U. Same.
V. C. E. Fisk, Deerfield.

HOW THE PRIZE BUTTER WAS MADE. — STATEMENT OF C. E. FISK OF DEERFIELD.

The butter is the product of three Jersey cows, — one thorough-bred and two high grades. They are fed with two quarts each of Indian meal and wheat-bran, and one peck of roots per day, to each cow, together with all the early-cut hay they will eat. They also have all the salt they wish. The "Perfect Milk-Pail," sold by the Dairy Supply Company of New-York City, is used for milking. The milk is set in shallow pans, allowed to stand from twenty-four to thirty-six hours, always skimming while sweet. The cream is kept in stone crocks, and thoroughly stirred every time a fresh lot is added. It is brought to a temperature of sixty degrees

before churning. As soon as the buttermilk separates from the butter, not after the butter is worked into large lumps by the churn, it is drawn off, and the butter washed free of all the butter-milk remaining. It is then taken from the churn, salted with Higgins's Eureka Salt, using three-fourths ounce to a pound of butter; stands for twenty-four hours, and is then worked and packed. The utmost pains are taken to keep every thing used about the dairy sweet and clean.

STATEMENT OF C. B. MERRITT OF CONWAY.

The milk is set in shallow pans; stands from thirty-six to forty-eight hours, according to the weather; is churned twice a week in a dash-churn, one small teaspoonful of Wells, Richardson, & Co.'s "Perfected Butter-Color" being added to the cream before churning for every ten pounds of butter. Half an ounce of Higgins's Eureka Salt is added for every pound of butter. When it is taken from the churn, it stands from ten to twelve hours, when it is worked on a common butter-worker, and put in the boxes.

STATEMENT OF L. F. AND W. H. GRAY OF ASHFIELD.

The milk is strained while warm, through a fine wire strainer, and also through cloth as thick as it will readily pass through. It is set in the old-fashioned small pans, and skimmed after standing twenty-four hours, the cream being well mixed at each addition. We churn twice a week, using all the cream gathered previously to the morning of churning. The cream, if thick, is well thinned with skimmed milk, so as to run steadily. Just before the buttermilk separates, more milk is added, — two or three quarts to a churning of twenty-five pounds. As soon as the buttermilk will run, it is drawn off, and more milk added, in which the butter is gathered. It is then taken on to a lever butter-worker, partially worked, weighed, and salted, half an ounce to a pound; the American Dairy Company's "Extra F. F. Dairy" being the brand used. After standing about twenty-four hours, it is thoroughly worked, and packed for market. Carrots are used for coloring. Our cows are grade shorthorns and natives.

STATEMENT OF J. C. NEWHALL OF CONWAY.

This butter was made from a dairy of eighteen to twenty cows, fed on early-cut hay, rowen, and corn-fodder, with a feed twice a day of corn-meal and wheat-shorts. The milk was set in shallow pans, and skimmed after setting thirty-six hours. The cream is churned every other day at a temperature of sixty degrees. When taken from the churn, it is salted, half an ounce to the pound. After standing about eight hours, it is worked over, and packed.

STATEMENT OF THOMAS J. FIELD OF NORTHFIELD.

My cows are most of them Jerseys, — Jersey grades with Guernseys. Their winter-feed is early-cut hay, with six quarts of roots and four quarts of cob-meal per day. Summer feed: soiled mostly on clover and fodder-corn. I prefer sweet-corn, and to let it mature enough to form ears. The milk is set in shallow pans, each pan holding a milking. We take off the cream in about thirty-six hours. Churn, Bullard's Oscillating. The butter is washed in brine. Salted with four ounces to ten pounds of butter, the salt worked in, and prepared for the market by putting in prints at once. Higgins's Eureka Salt is used.

STATEMENT OF F. H. HAWKS OF CHARLEMONT.

The butter was made in one week, beginning on Saturday, Nov. 22, and ending the following Saturday. The milk was set in old-fashioned tin pans; the cream allowed to stand thirty-six hours before skimming; churned and worked in the same churn. Wash till the water runs clear, and then put in half an ounce of Higgins's Eureka Salt to every pound of butter. Let the butter remain in the churn for about eight hours, then work, and pack for market.

DAIRY APPLIANCES AT THE MASSACHUSETTS BUTTER SHOW.

Much of the interest attaching to the butter show, especially for the hundreds of practical butter-makers in attendance, was due to the enterprising and public-spirited manufacturers and agents, who, at much trouble and ex-

pense, brought to Greenfield, and there exhibited, a very large and valuable assortment of improved dairy implements. No premiums or pecuniary inducements were offered; but the responses to the invitations of the committee were so numerous, that it became a serious matter to determine what should be done with all the apparatus arriving. The display of butter assumed such dimensions, that the original plan, of placing both butter and utensils in the lower hall, had to be abandoned; and it was finally decided to locate the implements and their exhibiters in the passageways and on the stair-landings between the butter show and the upper hall, where the meetings were held. The only alternative was a hall in a separate building, some distance from the centre of interest. To this arrangement the exhibiters very cordially assented, although the accommodations were far from what they had a right to expect, and by no means did justice to the merits of their articles. Making the best of the situation, these gentlemen occupied the several locations assigned them, and for two days were the centres of interested groups of visitors, to whom the appliances were carefully shown, and minutely explained.

Vermont took the lead in this department; the well-known makers of dairy fixtures at Bellows Falls, Poultney, Burlington, and Peacham, showing samples of their several manufactures. The Vermont Farm Machine Company exhibited the famous Cooley Creamer, the Davis Swinging-Churn, and the Eureka Butter-Worker, several sizes of each. The Cooley Creamer has, probably, a wider reputation than any other single one of the modern American dairy appliances; and butter made by this process has been remarkably successful at the various shows, taking more premiums during the last two or three years than that made by any other special process. This creamer in its latest patterns, includ ing the cabinet form, one with cans which may be emptied without removal from the tank, one with hoisting attachment, and the new metallic valve and discharge-tube (a very decided improvement), shows that the makers are not contented to rest upon honors won, but aim at perfection in the work. The Davis Churn of wood, excellent in shape, well made, and efficient in its work, received the first premium at the International Dairy Fair; and in the official report of

the British Dairy Show at London, in October last, is stated to have been "the favorite with the visitors, of all the American churns exhibited." The Eureka Butter-Worker is all wood, simple, and easy to manage: it received a special diploma at the International Fair; and the judges reported it "the best worker shown, in the hands of a discreet butter-maker."

Messrs. Moseley and Stoddard exhibited several articles from their "New-England Dairy Supply Depot." More's Pryamidal Milk-Strainer needs only to be seen to be appreciated: it is certainly one of the most valuable of the recent additions to dairy utensils. The Surprise Churn has also hosts of friends, and was apparently a special favorite at this show. The cabinet creamery is a very compact, handy appliance for deep setting at low temperature, arranged for great economy of water and ice. This new invention won the highest prize at the last New-England Fair, and is favorably received wherever shown.

Mr. Van Patten represented both the Ferguson Bureau Creamery, and the celebrated Perfected Butter-Color of Wells, Richardson, & Co. The latter needs only to be mentioned: it undoubtedly has a far larger sale than any other article of its kind, in England as well as in America. The Bureau Creamery is a comparatively new contrivance, but is attracting much attention on account of its simplicity, economy of labor, adaptability to the use of either air or water in regulating the temperature, and its adherence to the old plan of shallow setting, in which most butter-makers in New England still believe. The exhibiter justly exulted over the fact that every one of the principal premiums at this State show was awarded to butter made on the shallow-pan system.

From Peacham, Vt., were sent, by Mr. J. R. Kinerson, a twenty-four-pound butter-carrier with box mould for putting up butter for transportation; also stamps or prints, roller, pestle, cutter, &c., for easily stamping and packing butter in small fancy packages to be sent in the carrier or boxes to market. Convenient and useful articles.

The Dairy Supply Company of New-York City was represented by its manager, Col. Mason C. Weld, who exhibited a great variety of standard dairy utensils with new and useful

appliances. The Perfect Milking Pail, combining stool and pail in one, is highly commended by all who have used it, as insuring safety from accident, cleanliness while milking, and the greatest possible protection from dust and foul air. Several of the glass milk-cans so rapidly coming into use for city delivery were in this collection, among them the Warren Bottle, the Putnam Bottle, and the Crystal Jar. The "Monitor," or "Pendulum," churn, excited general interest from its odd shape and the novel way of hanging and operating it: upon examination it proved to be very cheap for so good an implement, all tin, and therefore light, easily cleaned and handled, and well-nigh perfect in action. It is especially adapted to use with thin cream from deep setting, and to making butter by the granular method. Nesbitt's Butter Presses are wholly of wood, well made, in few parts, simple, easily cleaned, and operated by a lever. A pound or half-pound lump of butter being accurately weighed, and given a rough cylindrical form, one of these presses will instantly make it into a round or square print, solid, well-shaped, with or without a stamp upon the cake. For those making lump or print butter, one of these handy little presses, which costs only five dollars, would seem to be a very economical assistant. Col. Weld also exhibited a much more complicated and expensive press, Rapp's Patent, considerably used in Pennsylvania, which fixes any desired stamp or design upon five sides of a cubical pound lump at once. This is a valuable machine for large producers of "gilt-edged" prints who need to guard against imitation, but can never come into general use. Several excellent butter-packages of different sizes and kinds were shown by this company, including the Bradley Boxes and Pails and the Koehler Tub, as well as dairy glass-ware, and numerous small articles of use in handling milk and butter. As a whole, it was a well-assorted and interesting collection.

William E. Lincoln of Warren, Mass., was present with one of his Portable Scientific Creameries. This is a new invention, for which much is claimed: it was shown for the first time at the New-England Fair of 1879, and has yet to make its reputation for practical economy. The Patent Pneumatic Skimmer exhibited with this creamery was a decided novelty.

H. I. Carver's combined Butter Worker and Mould, made at Chicopee Falls, is a cheap and handy implement, highly commended by those who have used it. That veteran agricultural inventor, E. W. Bullard of Barre, not content to rest upon the fame of his hay-tedder, and the Oscillating Churn, which is so deservedly popular with many of the best butter-makers of New England, was present with some new examples of his ingenuity. His Champion Churn, patented last July, is a covered wooden tub, with handle and cover in the centre of the top, which rotates upon a spindle, its action making available the natural centrifugal force, and is held within limits by a circular iron rail. It was quite new to most visitors, received much attention, and its owner showed strong testimonials as to its efficiency from citizens of Barre, Brookfield, Brimfield, and Charlton. The Worcester County Milk-Pan was also in charge of Mr. Bullard: it has not a wide reputation, but has received the highest honors at several county fairs in this State, and is indorsed by the president and superintendent of the Barre Central Cheese Factory.

A number of other churns were on exhibition; those receiving most attention being the Double-acting Churn of Elmer Brothers of Shelburne Falls, which has a high reputation in Franklin County, and the well-known Blanchard, whose owners continue to make improvements, and still claim to produce "the best." Both these churns are horizontal wooden cylinders with rotary dashers turned by a crank.

Among many other single articles exhibited which cannot be described at length, were the Badger State Creamery-Cans of Davis and Fairlamb of Chicago, the Dairy Salt exhibits from New York, Higgins's Eureka by the Messrs. Thurber and Ashton, by F. D. Moulton and Co., Mrs. D. C. Perrin's June Butter-Color, or Colored Salt, and some superior butter-tubs and return-pails, called Optimus, sent by James Gilberds of Jamestown, N.Y.

The Centrifugal Cream Separator was, however, the greatest novelty of all the dairy appliances exhibited; and Mr. Bond was kept busy from morning till night in answering eager questioners among the crowd which pressed about him. It was unfortunately found to be impossible to supply the requisite steam-power to fully operate the machine; but the

two working models could be fairly managed by hand, and the exhibiter showed the principles involved, and fully explained the process. This is the American machine, invented and put in practice simultaneously with the Swedish and Danish separators, which have attracted so much attention in Europe the past year, but entirely independent of them. Rev. H. F. Bond of Northborough has been the principal inventor, and the models exhibited were his; but he has had the aid of Mr. Edward Burnett's good judgment and practical experience in making the necessary modifications and improvements. The first completed separator put into use in this country was built by D. M. Weston of Boston, after the Bond-Burnett patterns, and is now in successful operation daily in Mr. Burnett's dairy at Deerfoot Farm, Southborough, Mass.

A number of the creamers, churns, and butter-workers in the collection, were shown in operation, greatly increasing the interest of the exhibit; and this was rendered possible through the generous action of the Greenfield Farmers' Club, in supplying milk and cream for the purpose, and providing an efficient committee to attend to the wants of the exhibiters.

Since the meeting and show, several prominent manufacturers have expressed extreme satisfaction with their experience in exhibiting dairy apparatus at Greenfield, stating that they never met so intelligent and earnest an audience; the visitors all seemed bent on gaining information, knew just what they wanted, and were quick to see the merits and the faults of the many new appliances.

Adjourned.

THIRD DAY.

The morning session commenced at ten o'clock, J. H. Demond of Northampton in the chair.

The Chairman. The subject announced on the programme for this morning is one of the most important that can be presented to those interested in the dairy, and the gentleman who is to address you is one of the most thoroughly-posted men on that subject in the country. I have the pleasure of introducing Col. Willis P. Hazard of West Chester, Penn.

GUENON'S SYSTEM OF SELECTING COWS BY THE ESCUTCHEON.

BY WILLIS P. HAZARD, SECRETARY OF THE PENNSYLVANIA GUENON COMMISSION, WEST CHESTER, PENN.

The time is not long since, when it was said "Cotton is king." But statistics prove that it has been dethroned, and that the dairy, with its products, has assumed the sceptre. When we consider that there are in value one million dollars a day, for every day in the year, sold of dairy products, and the total yearly products are seven hundred and fifty million, and there are from thirteen to fifteen million cows in the United States, we need hardly call your attention to the importance of the subject. But we desire to hold your thoughts to one branch of this subject, — the cow; for it is through her all these treasures are produced, and my aim will be to show how all these treasures may be increased. It will be done through explaining the points of Monsieur François Guenon's system of selecting cows by the escutcheon. For if, by this system, you can not only *increase the quantity* of milk produced, but also *improve the quality*, you must admit that increased receipts of money will follow.

You can readily see, if the average yield of a herd is *six* pounds of butter per head each week, and that yield can be increased to *nine* pounds, without any more cost, that the last three pounds' increase will be all profit; or, to put it in another way, if at present your milk is pretty good, and gives you a pound of butter to every twelve quarts of milk, how much your profits would be increased, if, with the same labor, it took only nine quarts to make a pound of butter.

Now, this can be done. And the surest way to do it is to raise the tone of your herd. No farmer should hesitate a moment to accomplish this purpose; and it makes but little difference how it is done, — whether it be through careful breeding, judicious purchases, or intelligent feeding. Adopting either of these, or even all of them, the keynote is

PROPER SELECTION.

Every one has his own views about this. One will choose by the crumpled horn, the large, thin-skinned udder, the large milk-veins, and their entrance into the belly, the color

and texture of the skin; while another will judge by the feminine appearance, the wedge-shape, the yellow ears, the small head, and the broad muzzle, or by some other favorite method. Yet, with all these marks, every dairyman will occasionally purchase an animal that deceives him at the milk-pail or the cream-pot, and she is apt to be the handsome one. The system of Monsieur Guenon does not interfere with any of these modes of judging; it simply harmonizes with and becomes an adjunct to them. Now, if you have one, three, five, or six points by which to judge the value of an animal, why not add to them still one more, especially if that one is worth more than all the others put together? With none of these modes can you tell just what a cow will do; with all of them combined you may select a pretty good cow, and at other times you may not: but by the escutcheon marks, and the other points by which Guenon judged, you can very surely tell whether the cow about to be purchased is a good one, how much milk she will give, how much butter she will make, and how long she will milk. In these times, when competition is so keen in the butter and cheese market, it behooves every man to understand his business, and have his herd of the best. The cow is his best machine; and the old adage of "goods well bought are half sold" applies here perfectly. A well-selected cow will always prove a profitable investment. This system will enable any one to tell the cow which is going to fail in her milk, and go dry for too long a time to be profitable; and it should be acquired, if only for that purpose.

SKETCH OF GUENON.

First let us see who Guenon was. Guenon as a boy was a young cowherd, living near Libourne in France. His father, a gardener, had early taught his son the varieties of plants, and thus he was led to notice the classifications and kinds of fruits and plants. He studied the works of the best writers on botany and agriculture, and applied his knowledge by following up all the ramifications of the vegetable kingdom, studied their external signs, and ascertained their qualities and productiveness. His mind was thus trained for developing his after-discoveries.

When he had the care of cows as a cowherd, he took

them to and from the pasture, and watched them all day; for in France, having no fences, the children, in turns, watch their own and their neighbors' cows. Thus various breeds and qualities of cows were constantly under his eye. A thoughtful lad, he was one day rubbing them down, when he noticed the difference in the hair, parts of it running upward, contrary to the usual growth of hair on the animal. In addition to the significance of the variations in the leaves and kinds of plants, he had heard mentioned some quirls in the hair, and other signs, which were said to have some significance. The thought struck him, Could there be any visible marks denoting different values? The thought once raised, he pursued it from day to day, from year to year, all the time discovering new points, which finally led him to believe he had made important discoveries. Like the learner of the present day, he met many things which frequently made him doubt, and which were great drawbacks to the system of classification he was endeavoring to form from the yet conflicting appearances.

His attention to the matter having first been drawn by the dandruff on certain spots on the hind-parts of the cow, and the variations of the hair, in pursuing these inquiries he found a great variety in the *shapes* of these quirls. This led to a new train of reflection and observation, which resulted in his becoming convinced that these shapes were the signs by which to distinguish cows, and to know their good and bad qualities.

After years of perseverance, he got his ideas into such a fixed arrangement that he was emboldened to give it to the world, and stand the scrutinizing tests of committees of various agricultural societies. The result was shown in the many orders for his book, the medals and membership certificates of the leading societies, and a pension from the government of three thousand francs for life. The value of the system was established. It has spread into every country where agriculture is encouraged, and his work has been frequently translated.

As we look at his portrait, he appears to have a clear eye, a cool head, great determination, firmness of character, a well-balanced mind, and, with it all, a vigor of constitution which buoys him up, and enables him to override obstacles.

HIS SYSTEM.

His system was based upon the discovery that on the posteriors of the bovine race, reaching from the vulva, and extending down over the udder, and on the inside of the thighs, a portion of the hair grew upwards, and was easily distinguished from the surrounding hair growing downwards. In so doing, the upward hair takes different shapes, which he called escutcheons. The size and shape of these indicate the quantity of milk the cow will give and the length of time she will continue to milk after calving. This latter was also affected by certain tufts of coarse hair, or blemishes on the escutcheon.

Then he noticed the character of the hair growing upon the escutcheon, the color of the skin under it, and the quality of the skin. It depends upon the quality of the hair and the skin to define the quality or richness of the milk the animal will give. The indications of the best quality, by the hair, are where the hair is short, soft, silky, furry; and, by the skin, where the skin is soft like a kid glove, very oleaginous, unctuous with the richness or fat pervading the animal, and exuding through the skin, and forming dandruff. The nearer the color of the skin comes to that peculiar rich yellow or copper color which Guenon calls Indienne, or nankeen color, the better it is. Particular attention must be given to these points, for they have a great bearing on the judgment to be formed; and the escutcheon is only to be judged in connection with these and other points.

In addition to the escutcheon, the hair, the skin, and the color of the skin, there are other points quite necessary to interpret infallibly. These are the breed, the size, the feed, the care and treatment, the surroundings (such as climate, temperature), period of gestation, and age of the animal. The breed must be considered, because it will affect the quantity, quality, and size of the animal. For instance, we should not judge the little Jersey from the same stand-point as the Durham; in one case the size of the Jersey, even with the same class and order of escutcheon, would indicate a less quantity of milk; yet the Jersey would most probably indicate a better quality. So we would not judge an Ayrshire from the same point of view as a grade cow, or

a so-called native. Different breeds, too, have a prevalence of a similar class of escutcheon; thus a Jersey will rather incline to the Selvage and Bicorn escutcheons; a Durham and a Dutch, to the Flanders; while grade cows will be of more variety in their escutcheon, and harder to place in a class, from the mixture of two classes of escutcheon being brought together, as developed on two breeds or mixed breeds.

The rules of the system are as applicable to calves and bulls as to cows; for by them can be told, after three months, whether it will pay to raise the calf, or to dispose of it, — if a cow calf, whether it promises either or both quantity and quality; if a bull calf, whether his "get" is likely to prove valuable. In either sex, the young should be judged by class and size of escutcheon, by the color and texture of the skin and hair. Thus a saving is effected in not being at the expense of raising a poor calf, and not being disappointed in future results. From this ability to raise or purchase only the best, the improvement of the herds will be very great, and we shall breed only the best.

Then there is another novel point about the system. It enables the purchaser to avoid those cows which Guenon called bastards: the French term may more properly be translated "spurious." These cows seem to have preserved their natural tendency to give enough milk only, and long enough, to raise their calves: therefore they go dry more or less early after they are impregnated. They are generally vigorous and handsome cows, and raise large, strong calves, because their milk is absorbed by their natural tendency to nourish the fœtus. As they are fine-looking cows, and generally in good condition, they are the more apt to deceive a purchaser. Guenon's system is invaluable, and should be learned by every farmer to save him from making such unprofitable and annoying investments.

In certain points this system is infallible, and in others it may so depend upon the judgment of the practiser as to make the system appear at fault. The infallible point is, that a cow having a first-class escutcheon, with soft, oleaginous skin on it, and with short, fine hair, is invariably a first-class cow in every respect. And just as much as she varies from that class, just so much is the quantity and quality of

her yield affected. Beware of a cow with a white, thick, unpliable skin, with coarse, harsh hair, particularly on the back of the udder, where it will often be found long, plenty, and wiry, and feeling harsh and dry to the hand: this is most often found on white skins that are free from any dandruff. They may, if they have a large escutcheon (and they very often do), give a large quantity of milk for a time; but it will be bluish, and of a serous character, making little or no butter, and, if any, of a white, lardlike appearance.

GUENON'S CLASSIFICATION.

In the last revised edition of Guenon's book he revised the whole system, simplifying and improving it. He classifies the various shapes of escutcheons into TEN CLASSES. Each one of these ten classes has SIX ORDERS. Each class represents a gradual reduction in the quantity given, and each order represents a gradual reduction in the time; so that a cow of the *first class* and *first order* will represent a very much larger escutcheon of the *Flanders* shape, and a larger number of quarts, and a longer time for milking, than the *first class* and *sixth order*. And the first class, first order, will give twenty quarts, and milk nine months; while the cow of tenth class and sixth order will only give three quarts, and milk three months. The one is most valuable, while the other is utterly worthless. If the system enables the purchaser to pick out the one, and to discard the other, it will need no one to praise it to him.

Guenon thus made the *perfect* shape the representative escutcheon of its class; and just so much as it varies from that, and gets smaller, just so fast does it descend in the *orders* of that *class*. Suppose the *first order* of every class should represent one hundred, then the next size smaller in that class may be represented by ninety, the next by eighty, and the fourth order by sixty; for they drop much faster, in proportion, as they descend in the class to the sixth order.

Now, as a general rule, it is safest not to buy a cow below the fourth order of any class, and, of most of them, unsafe below the third order.

The ten classes and six orders are represented by sixty escutcheons, and to each class there is a bastard escutcheon, making ten more, or seventy, to which we may add ten classes

of bulls of three orders each, or thirty, making in all a hundred varieties of escutcheons to learn. But omitting the orders below the third, as they are not necessary to be learned, reduces them by thirty; and as the bastards are exactly the same, with only two varieties of bastard-marks, we need learn but two, so that cuts off eight more; then, as the bulls are marked the same as the cows, we cut off thirty more; so that the hundred is reduced to only thirty-two that it is necessary to be well acquainted with.

These we simplify again, by calling your attention to the fact that the thigh-escutcheons are all very much alike: therefore, when you have learned one, you have learned all, the only difference being the reduced size and some imperfections. It is the *vertical* portion that decides the class in which the cow is to be ranked: therefore you will become familiar with the ten vertical portions of the escutcheons. With this point gained, and the judgment properly exercised to tell to which order of the class you have decided the cow belongs, and a proper sense of handling the skin and hair, you see the system is very simple, and soon acquired. Our Handbook, with its hundred illustrations, gives the number of quarts each class and order give, and the time the cow will milk; and with a little practice with it in the barnyard, and knowing what his cows will do, any intelligent farmer will soon become *au fait* in the system.

THE ESCUTCHEON.

We have now the outline of Guenon's system; let us examine more in detail into the variety of escutcheons. The drawings given here represent the *first order* of each of the ten *classes*, with the quantity given by each class and the length of time they will milk. The *quality*, of course, is indicated by each animal. One hour in the barnyard is worth hours of description; and at each lecture I endeavor to have the opportunity afforded to show practically on the animals the different escutcheons, and how to learn the art of handling.

The quantity given to each one here is to be modified by the size of the animal. For instance, many large and vigorous Durhams with a first-class Flanders escutcheon will give twenty-five quarts, instead of twenty, as called for;

while a medium-sized Jersey with the same grade of escutcheon would give but fifteen quarts. The breed and size will always modify the quantity, to raise or lower it. Let the learner not be disheartened at that; for practice, and his own knowledge of what cows of certain sizes and breeds in good condition will do, will soon guide him in forming his judgment. The figures represent what cows will do that are rather above the medium height and size. Guenon graded his cows into three sizes. His high cow is five hundred and fifty to six hundred and fifty pounds, *dressed weight;* the medium, three hundred and twenty-five to four hundred and fifty pounds; and the low, a hundred and ten to two hundred and twenty-five pounds. To Class 1, Order 1, he gives to the high, twenty-four quarts; to the medium, nineteen quarts; and to the low, fourteen quarts. It would not, therefore, be judging by the Guenon system correctly, unless the size was taken into consideration.

The escutcheon is that surface of the udder, the perinæum, and the thighs, where the hair grows upward. On all the remainder of the animal the hair grows downward. Escutcheons extend, according to their class, from the centre of the four teats to the level of the upper extremity of the vulva, and may extend in breadth from the middle of the hinder surface of one leg to the middle of the hinder surface of the other. By their form or configuration, escutcheons characterize and distinguish the ten families which together constitute Guenon's classification.

Each of the *classes*, or families, is of fixed form, always similar to itself, but variable in the dimensions of its surface, and is estimated by the limits of the escutcheon. The extreme limits are the hams, the interior surface of the legs, and vulva. It is the variation of the extent of this surface which divides each class, or family, into six *orders*. The escutcheon of the first order is the most developed, and is also the best marked; that of each of the lower orders is similar in form to the first order, but is in a reduced proportion, or with the dimensions reduced, or brought into less extended limits, reaching no longer the hams, nor covering the interio of the thighs, nor yet reaching up to the vulva. In any case, the broader it extends upon the thighs, the lower down and higher up the broad part covers, and the higher up and the

broader the vertical portions are; and the more perfect and equal, or uniform in the shape of its class it is, the better is the escutcheon.

The lower half, or broad portion, of the escutcheon, is of nearly similar shape in all the classes; only in the lower classes it is not quite so broad, nor quite so high up, as on the better classes; while the vertical portions gradually diminish both in height and breadth, until, in the tenth class, there is none at all. We, therefore, in speaking of the escutcheon, divide it into two parts. The lower portion, or broad part, running on to the thighs, we call the thigh-escutcheon: the upper portion, which extends up to the vulva, or towards it, we call the vertical portion. The thigh-escutcheon in all the classes resembles a round-pointed shovel; while the vertical portion may be likened to the handle. Now, remembering this fact, that the vertical or upper portions are what mostly distinguish the different escutcheons, will show that most attention is to be paid to the vertical part; also it is about the upper part the blemishes usually appear which detract from the value of the escutcheon.

The lower part, or thigh-escutcheon, indicates the quantity of milk the cow will give; the upper portion, or vertical escutcheon, the time she will milk; and the color of the skin, the feel of it, and the character of the hair on the escutcheon, will tell the quality of the milk. And these three points must be judged partly, also, by two other matters, — the size and the breed of the cow. The nearer any cow comes, in hair and mellowness of hide, to the characteristics of a first-class Jersey cow, the nearer she comes to first quality for richness of milk and for butter.

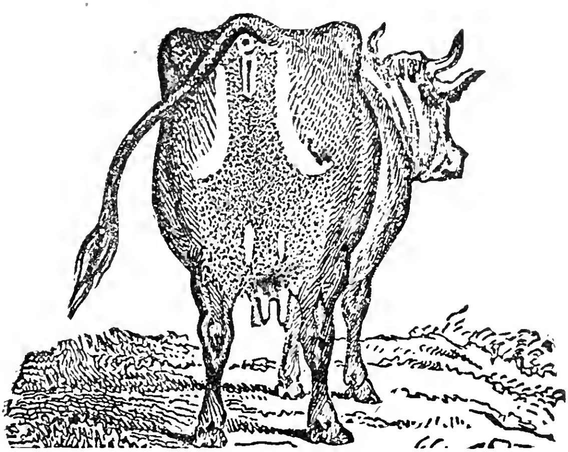
The effect produced by the change in the direction of the growing of the hair, which forms the escutcheon, is not glaring on the animal. It is merely a difference of lustre, and the gloss on the surface of the escutcheon, from the part of the skin surrounding it. The hair of the escutcheon is finer, shorter, more furry, and more silky. Its appearance at first glance makes one think this part of the animal has been shaved, and is perhaps quicker seen than the hair on the rest of the animal. It is more easily seen in summer, when the hair is shorter, and usually the animal is cleaner, and the hair more glossy from the nature of its feed; also it is to be

seen better when the animal is near her period of calving, or just after it, as the udder, the veins, &c., are more distended. The drawings of Guenon represent the escutcheon as it would be seen if the skin of the udder and escutcheon was stretched upon a board; and it oftentimes can be seen much better and more truly if the thighs are stretched apart, and the skin distended by the hands. If in winter there is any difficulty in seeing the outlines of the escutcheon clearly, by drawing the back of the hand down it, with the nails downward, they will rub against the up-growing hair, and it will thus be easily defined. Also, if the cow advances a few steps slowly, it will show the different parts more surely.

The escutcheon also indicates, in all animals whose escutcheons are of the first order, that are in good health, and to which no accidents have happened, as plainly its generative ability as its production of milk. It is therefore highly important the bull should have a good escutcheon as well as good shape, fine hair, and fine skin.

NAMES OF THE ESCUTCHEONS.

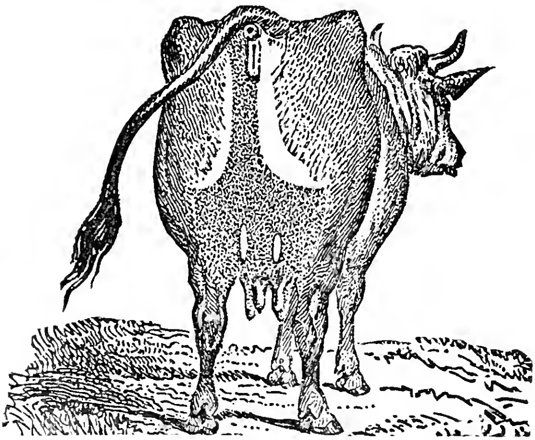
The names which Guenon gave to his ten classes of escutcheons were arbitrary, and have but little significance.



FIRST CLASS, FIRST ORDER. — FLANDERS.
Twenty quarts, nine months.

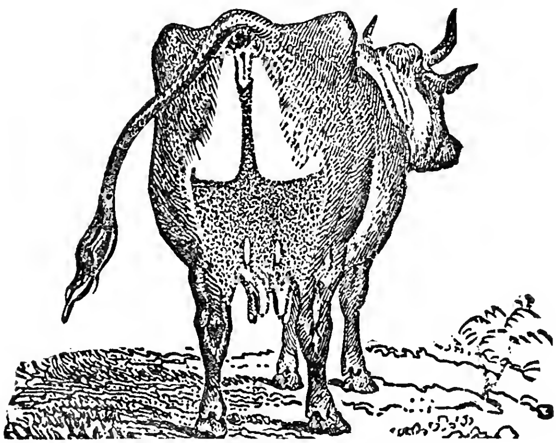
The first class he called Flandrine, or Flanders, because it is the best; and he named it after the best cows he knew, —

those from Flanders or the Flemish breed, and they had more cows with this escutcheon than those of any other breed.



SECOND CLASS, FIRST ORDER. — LEFT FLANDERS.
Eighteen quarts, eight months.

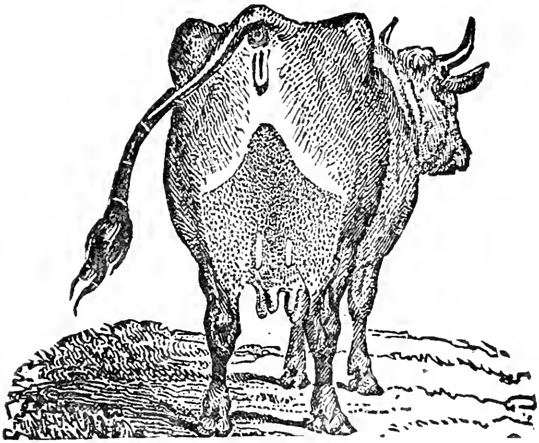
The second class he called Flandrine à Gauche, or Left Flanders; because it has a Flanders escutcheon, but it extends up entirely to the left of the vulva.



THIRD CLASS, FIRST ORDER. — SELVAGE.
Nineteen quarts, eight months.

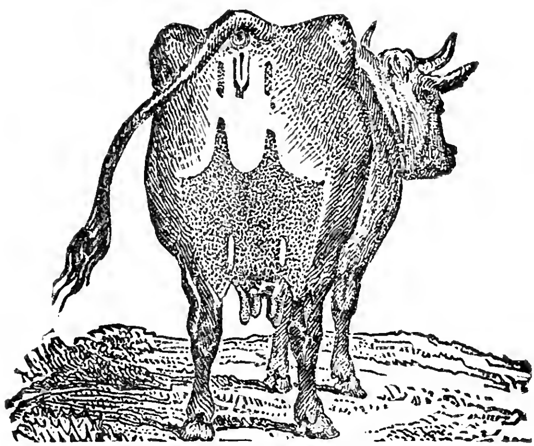
The third class he named Lisière, or the Selvage, from a fancied resemblance to a selvage, or binding of a piece of cloth.

The fourth class are the Courbe-Ligne, or Curveline, be-



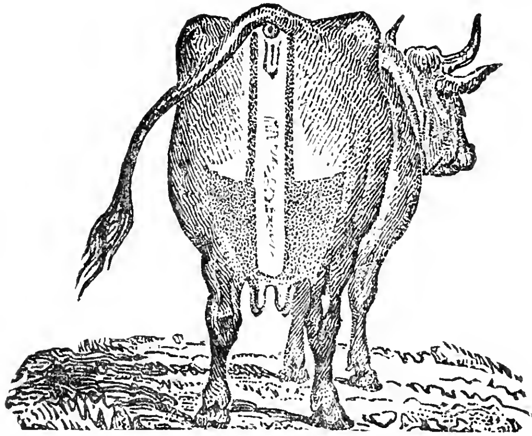
FOURTH CLASS, FIRST ORDER. — CURVELINE.
Nineteen quarts, eight months.

cause their escutcheon is lozenge-shaped, formed by a curved line which sides to the right and left.



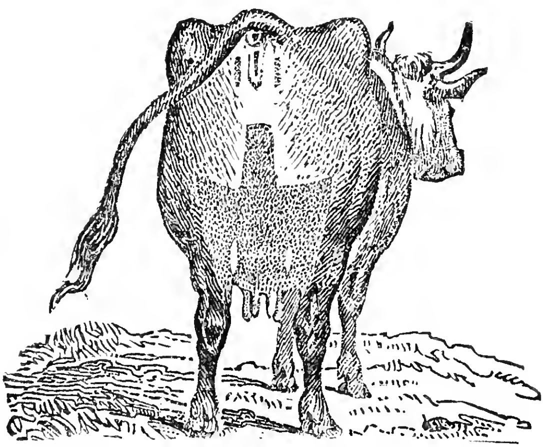
FIFTH CLASS, FIRST ORDER. — BICORN.
Seventeen quarts, eight months.

The fifth class are Bicorn, because the upper part of the escutcheon forks in two horns.



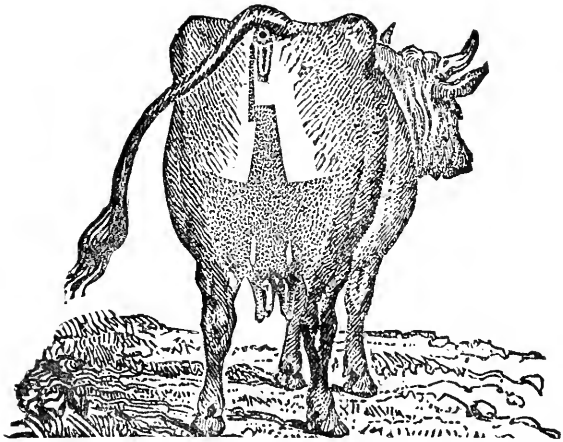
SIXTH CLASS, FIRST ORDER. — DOUBLE SELVAGE.
Eighteen quarts, eight months.

The sixth class, Double-Lisière, or Double Selvage, is an odd freak of nature.



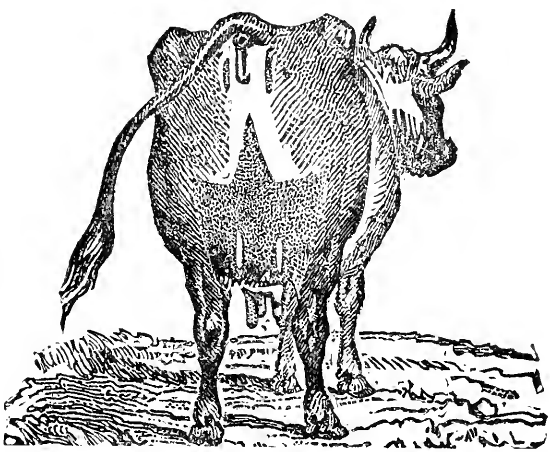
SEVENTH CLASS, FIRST ORDER. — DEMIJOHN.
Seventeen quarts, eight months.

The seventh class are Poitevine, or Demijohn, from a fancied resemblance to some kinds of demijohns.



EIGHTH CLASS, FIRST ORDER. — SQUARE ESCUTCHEON.
Seventeen quarts, eight months.

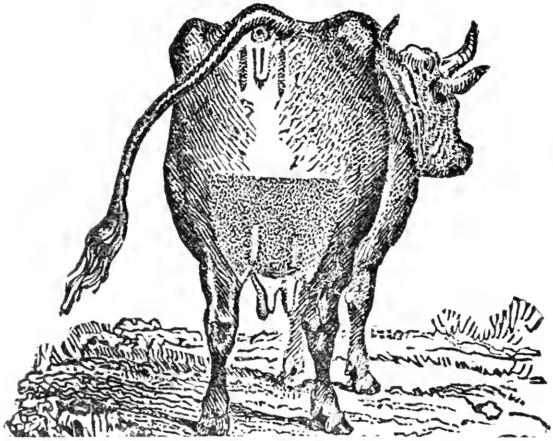
The eighth class he called Equerrine, or Square Escutcheon, as it is square at the upper part.



NINTH CLASS, FIRST ORDER. — LIMOUSIN.
Fifteen quarts, eight months.

The ninth class is the Limousin, as it was on a cow from that province that Guenon first saw this shaped escutcheon.

The tenth class he named Carrésine, or Horizontal, because

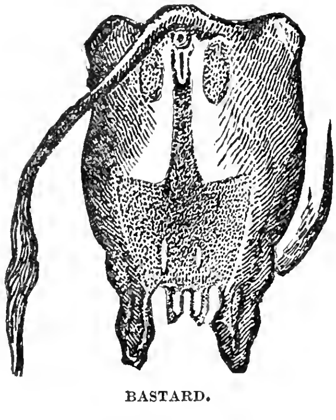


TENTH CLASS, FIRST ORDER. — HORIZONTAL.
Thirteen quarts, eight months.

the upper part of the escutcheon is cut squarely by a horizontal line.

THE BASTARDS.

Each of these ten classes have the bastard escutcheon; that is, there are some cows, which, though well marked,



BASTARD.

begin to fail in their milk as soon as they are with calf again. Some will fail very rapidly; others more slowly. They generally are marked first-class, and are the handsomest cows.

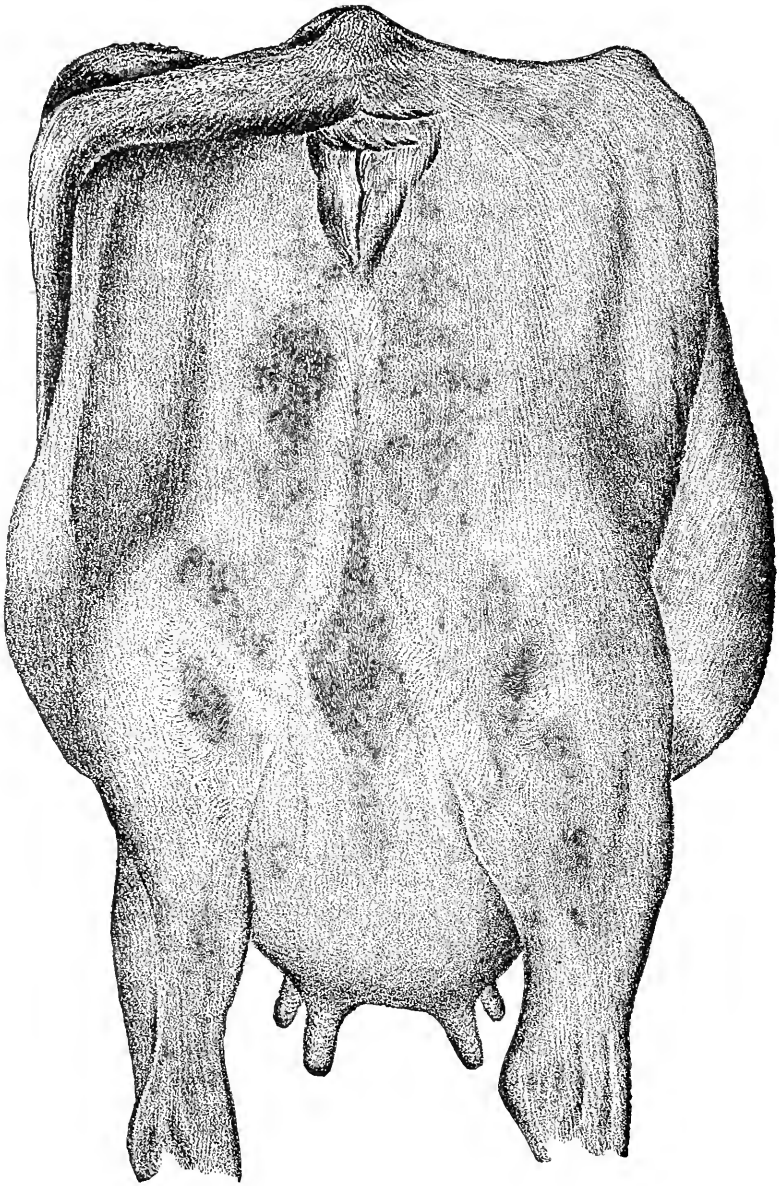
They are to be looked for carefully, as they often mislead the best judges. They are distinguished in the first, or Flanders class, by an oval in the vertical escutcheon; or by the hair on the edges of the vertical, where it meets the down-running hair, having a coarse, bristly, wiry character, and rather of a lustrous appearance, standing out from the body. The oval on the vertical has hair also of a shiny, lustrous appearance.

All the other classes have, alongside the vulva, two oval patches of coarse hair, one on each side. The larger the ovals, and the coarser the hair on them, the sooner they will fail. Generally speaking, if the animal is closely examined, the hair will be found harsh, dry, and long, particularly on the back of the udder; the skin is apt to be white and thick; little or no dandruff, and of a dry, scaly nature.

THE OVALS.

There is nearly always a sign accompanying a good escutcheon, and that is, one or two ovals on the bag, just above the hind-teats, on which a *fine* coat of hair grows downwards. They are shown on all the preceding engravings. These may be large or small, may be one or two, and may be alike or unlike in size; but they are always good signs. Two are better than one, and, the larger and more uniform they are, the better; and, the finer and softer the hair on them, the better the indications. No escutcheon is first-class if it has not both or one, and of good size. They are generally easily perceived by a whiter and more shiny appearance of the hair on them. If they are very large, and irregular in shape, and have very coarse hair on them, their value would rapidly diminish; and, in such cases, it will generally be found that there are other deteriorating signs.

There is still another very unfailing good mark, though it is not mentioned by Guenon; and the Pennsylvania Guenon Commission first brought it to notice, as their experience had long proved it to be a good sign. They call them *Thigh-ovals.* It is where the vertical loses itself in the thigh-escutcheon. Here the down-running hair makes a semicircular dip into the broad escutcheon. If this is of fine short hair, it is an excellent sign, and the Commission put great faith in it. My own cow, a Jersey (a representation of her escutcheon is



ROSIE.

Pure-bred Jersey, belonging to Willis P. Hazard.

given below), has these thigh-ovals so large, they extend down uniformly on each half of the udder, and embrace the lower ovals on the udder. I think she is like some cows, of which there are very few, that have four ovals; and she is so good that the thigh-oval dips down, joins the two upper udder-ovals, and continues on down, and absorbs the two lower udder-ovals. Her hide is the color of gold, and very unctuous or oleaginous, and her frame is that of a model cow, deep through, short-limbed. She gives sixteen quarts of milk, so rich that the cream thickens on it like butter, and can be taken off, and spread upon bread.

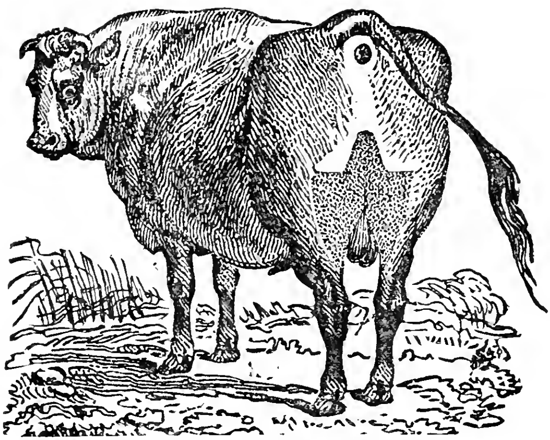
IMPERFECTIONS.

Besides these favorable marks, there are those which are imperfections, denoting a decreased yield, a poorer quality, or a shorter time for giving milk. As these must be learned with the book in hand, in presence of the animal, we shall not describe them here fully. The first and most important imperfection is that of the escutcheon itself. Where the escutcheon is irregular in shape in either class, not uniform on both thighs, then a certain discount must be allowed in proportion as it varies from the perfect one of its class. The most prominent imperfections are those about the vulva (which Guenon called *epis*, or *tufts*), and cuts or slices out of the outlines or sides of the thigh-escutcheons. He says the cause of these latter defects is, that the veins situated beneath, on either side of the belly, have a peculiarity,—that they are contracted, and there is a small opening for them where they pierce the abdominal muscles. All imperfections encroaching on the escutcheon diminish its value, and indicate a decreased aptitude for yielding milk. These tufts are classified into two kinds,—those on which the hair ascends, and those on which it descends. Coarse hair on the udder may certainly be considered a blemish or imperfection.

Sometimes there is an intermingling of two forms of escutcheons. This arises from the crossing of two animals having different classes of escutcheons, and sometimes renders it difficult to tell in which class to place the animal. In such cases, judge it by the class of escutcheon it the most nearly resembles.

ON BULLS.

Guenon, in his earlier editions, said nothing about bulls. In the revised and last edition, from which my book is translated, he has a special chapter, and thirty illustrations. This is a very important addition, as the choice of a good bull is the foundation of a good herd. Too little attention has been and is paid to the quality of the bull. He stamps his qualities upon his get. I have gone through herds, and picked out every animal gotten by one and the same sire.



CLASS FOUR, ORDER ONE.—CURVELINE.

Guenon says the characteristic signs with the males, as with the females, have a significant value of the highest importance: they portray the reproductive qualities, those having the largest and most perfect escutcheons possessing the greatest ability for procreating good milk cows.

As, also, with the cows, the color and quality of the skin, and the fineness of the hair, are thoroughly necessary to be first-rate.

There is one difference,—certain classes are much oftener found than others, and in this order: 1, Curveline; 2, Limousin; and, 3, Horizontal. The others are rarer, according to the order in which he gives them; the Flanders being the most seldom found.

CAUSE OF THE ESCUTCHEON.

The escutcheon was so called, we presume, from its similarity to the shape of a shield; and, on a first-class cow, the lower part of it will be very like it, or somewhat like a round-pointed shovel. On this escutcheon the hair will be generally of a different color from that bordering it, most generally rather darker, always shorter, and more nearly resembling fur. It thus becomes the outward sign of the milking and generative qualities of any cow, of any breed, that all may see and understand.

Why this escutcheon is placed there, why it varies on different cows, and what causes it, has not yet been positively settled. My own impression is, that, tracing cause and effect, it is the sign of vigor and constitution in the animal. If she is perfectly formed, in good health, she will generally be a good eater and good milker: these points develop the blood-vessels and the mammary glands largely. As the arterial vessels terminate in veins, the more vigorous the animal, the larger the veins, and the more widely they ramify; and, as they lay under the skin, they cause the hair to grow in a contrary direction. We present the statements of the ablest authorities, which tend to bear us out in our conviction.

Monsieur Magne, who early developed Guenon's system, accounted for the connection of the escutcheon with the flow of milk in that the hair turns in the direction in which the arteries ramify, and that the reversed hair on the udder and adjacent parts indicates the termination of the arteries which supply the udder with blood. When these arteries are large, they are not confined to the udder, but extend down through it, and upward and outward, ramifying on the skin beyond the udder, giving the hair the peculiar appearance which distinguishes it from the rest of the surface. If the arteries supplying the udder with blood are very small, they are not likely to extend much beyond the udder, and hence form a very small escutcheon: hence a small escutcheon indicates a feeble supply of blood to the udder, and consequently a small flow of milk.

This is the most likely explanation of these marks, and it is confirmed by the experience of each member of the Penn-

sylvania Commission. We have invariably noticed, where there are large, knotty milk-veins, so called, particularly when there are two on the belly, and the udder is covered with prominent zig-zag veins, and these extend up on the perinæum, that that cow is a first-rate cow, and, as such, she has a first-class escutcheon.

Professor Arnold, the highest authority in this country on dairying matters, quotes Monsieur Magne, and adds, —

"The size of the escutcheon is regarded as the measure of the quantity of blood supplied to the milk-producing vessels, and is evidence of their capability of elaborating milk. In the same way, the veins take up the blood, and carry it back in the milk-veins, which pass through the bag, and along the belly, and enter the body through one or more holes on their way to the heart. The size of the milk-veins, and the holes where they enter the body, vary with the escutcheon, and, like it, give evidence of the quantity of venous blood passing away from and through the udder, and they have the same significance with reference to quantity as the supply of arterial blood and the size of the escutcheon."

He adds, —

"But none of these indications, taken singly, is an infallible evidence of large yield. They must be considered together. A large escutcheon and milk-veins, coupled with a small stomach, would be marked down at least one-half of what they might otherwise signify; and a large digestive apparatus, coupled with small milk-veins and escutcheon, should be marked down in the same way. Keeping the leading indications in view, observation will soon enable one to make close estimates."

Dr. D. E. Salmon, one of the ablest veterinarians in this country, has discussed this question in a very clear manner. I have printed his article in my Handbook, from which I quote the following, though such fragments of his argument do not do him or it justice: —

"The mammary artery sends several divisions to the tissue of the udder, and is prolonged between the thighs by a perineal branch, which terminates in the inferior commissure of the vulva, after having furnished glandular and *cutaneous* divisions. . . .

"Magne's *facts* are correct, then, whether his inferences are or not. *The same artery that supplies the udder with blood supplies the skin on which the escutcheon is formed; and, more than this, the artery ramifies in the direction in which the hair of the escutcheon grows.*"

Dr. Salmon then quotes Erasmus Wilson to show the direction of the hairs on the anterior surface of the human

body, — that they grow downwards and upwards toward the umbilicus, "the convergence of four streams;" also that hair about the ears and neck grow in different directions following the arterial ramifications: —

> "In addition, Tisserant and others in France, who stand high as authorities, admit that the escutcheon continues to increase in relative surface till the second or third milking; that is, till the development of the udder, and, consequently, of the vessels supplying it, have reached their highest point. . . .
>
> "The cavity in the skin surrounding the hair (hair follicle) is set in an oblique direction, as well as the hair that emerges from it: the papilla at the bottom of this cavity must also be inclined; and it is this, that, in all probability, decides the direction of the hair, as the growth of this takes place by additions of cells from the surface of the papilla. Now, each papilla, or elevation, has a vascular loop, or, as some say, a minute artery and vein; and one can easily imagine how the direction of this minute artery might influence the direction of the papillary summit, and, consequently, of the hair that grows from it."

As to the value of the escutcheon, and its determining the qualities of the animal, we could quote the ablest writers on dairy matters, such as Charles L. Flint, Col. George E. Waring, J. D. W. French, S. Hoxie, Professor Henry Tanner of Queen's College, and many others.

The Dutch-Friesian Cattle-Breeder's Association have adopted rules that no cattle can be entered in their registry, unless they have the higher classes and orders of escutcheons as laid down by the Pennsylvania Commission.

GENERAL VIEW OF THE SUBJECT.

This science of Guenon is no new thing, nor a thing of a day. It was adopted, after ample testing, by the leading agricultural societies and by the government of France. The ablest scientific men have tested and approved of it in all countries; yet it has never been popularized in this country. The translation of Guenon's book by N. P. Trist gave only a portion of it; and at that time his system was crude and incomplete, and it has never been altered, or brought up to Guenon's revised rules and alterations, to this day. It still maintains the numerous divisions and subdivisions, amounting to two hundred, into which Guenon separated it with the exactness of an enthusiast, making it very forbidding, and dismaying many, nearly every one,

from taking hold of it. In his later issues Guenon simplified it very much, making more distinct classes, and reducing the number of orders, and giving a separate treatise on bulls. In order to simplify it much more. I have prepared a Handbook, and with so many illustrations, as to enable any intelligent man to become master of it in thirty days. It is published in cheap form to advance the knowledge of a system so beneficial to every purchaser of a cow. It is forwarded free by mail to any one who remits me fifty cents for the work. It contains also the complete report of the Pennsylvania Commission, which shows the comparative statements of the owner and the Commission, neither knowing what the other said about the cows until they were handed in for publication.

In 1878–79 this Commission acted under the orders of Gov. Hartranft of Pennsylvania, to test the system, and whether its reliability would recommend it for popular use. Their report of the examination of two hundred cows of various breeds shows a successful statement of their qualities to about ninety per cent. The mode of proceeding was to examine the cow, and make notes of her points as to quantity, quality, and time, of milking. This was independent of the owner; and the record was kept by the secretary. A similar statement from the owner, who knew, of course, exactly what his cows would do, and generally made beforehand, was afterward handed to the secretary of the Commission, who transcribed the two statements ready for publication in parallel columns: these statements were then placed with the originals before the owners, who compared them, and certified to their correctness as originally taken down, and they were ready for publication. This plan prevented any collusion, or any chance of altering to assimilate the two statements. The examinations were made only by the escutcheons; and no statements were allowed to be made by any one to the Commission, until after their judgment and record had been made. Some of the cows were blanketed, so that nothing more was shown than is to be seen in the engravings illustrating this article; this was done in the presence of a committee appointed for the purpose of seeing whether the Commission did examine only by the escutcheon; though that was asking more of even experts than Guenon claims

to be able to do, or should be done. We append the results of the examination of these seven blanketed cows: —

THOMAS GAWTHROP'S ACCOUNT OF COWS EXAMINED AT THOMAS GAWTHROP'S FARM SEPT. 20.

No. 1. VICTORIA. — Grade, Jersey and Durham. Quantity, first. Quality, first. A first-class butter-cow, and milks well up to time.

No. 2. CECIL. — Grade, Jersey. Quantity, first. Quality, first. First-class for butter. Milks up to time.

No. 3. NELLIE. — Quantity, second. Quality, second. Dry from ten to twelve weeks.

No. 4. LUCY. — Recently purchased. Yields, three months from calving, thirteen quarts. Quality, first.

No. 5. LILY. — Grade, Jersey. Quantity, second. Quality, first. Milks up to time.

No. 8. STAR. — Grade, three-quarter Jersey. Yield, with first calf, from twelve to fourteen quarts per day, and milks well up to time. Quality, first-class.

No. 9. NORAH. — Quantity, first. Quality, first. Dry from eight to ten weeks.

THE GUENON COMMISSION'S ACCOUNT OF COWS EXAMINED AT THOMAS GAWTHROP'S FARM SEPT. 20.

No. 1. VICTORIA. — Grade, Jersey and Durham. Eight years. Quantity, first. Quality, first. Up to her time.

No. 2. CECIL. — Quantity, first. Quality, first. Short eight weeks.

No. 3. NELLIE. — Demijohn, 1. Quantity, second. Quality, first. Short eight weeks.

No. 4. LUCY. — Flanders, 2d. Quantity, second. Quality, first. Up to her time.

No. 5. LILY. — Grade, Jersey. Flanders, 2d. Quantity, second. Quality, first. Dry four to six weeks.

No. 8. STAR. — Grade, three-quarter Jersey. Flanders, 3d. Quantity, second. Quality, first. Dry six weeks. Her Jersey blood helps to overcome some blemishes on her escutcheon.

No. 9. NORAH. — Grade. Quantity, first. Quality, first. Up to her time.

When the Commission state "up to her time," they mean up to within from "four to six weeks," as they think every cow should be rested full that length of time before calving.

Now we would ask, Is there any other system of telling the value of any number of cows that the experts never saw before, and knew not how they were fed or treated, that will give as close results as on the above cows, so blanketed that nothing was left but the escutcheon to judge from? Neither the size, condition, nor even the breed, could be seen enough to know any thing of these points.

We therefore urge upon every farmer to study and practise this system. Any intelligent man can readily acquire it; and by practising at every opportunity, at every cattle sale,

or visiting his neighbors, or at the farm club meetings, he will become more perfect: it will awaken a subject of constant interest, and, above all, will put money in his purse by the decided improvement to his herd and the yield therefrom. It does not interfere with any of your favorite modes of judging stock, it only adds a new one, — a valuable assistant. An adjunct to all other modes, it harmonizes with, and proves to yourself and others, the accuracy of your judgment. And it will enable you to avoid buying the short milkers, and help you to weed out the cows now standing in your stables, eating their heads off, and being a source of loss to you the longer they are kept. With the book in hand, go through your herd, and test them, and consign twenty-five per cent of your herd to the butcher.

I have observed, that, in the questions that have been asked at these very interesting meetings, something has been said in regard to the importance of the sire in breeding. There is one of the great advantages of this system. Ordinarily, a bull is preserved and kept, because he is good-looking, well-shaped, or something of that kind, when, perhaps, he has not the first characteristic for producing good milking animals. We all know that we are often disappointed when the animals we have raised come into milk, and of course there has been a great deal of loss. That animal must be sent to the shambles, because it would not pay to keep her. But if a bull has a good escutcheon, fine oily skin, and fine soft hair, then you may know that he is worth keeping and breeding from. I shall be glad to answer any question that any person wishes to ask.

Question. What is the appearance of the escutcheon in the male, and its extent? How are we to judge of the male?

Mr. Hazard. It has not been my fortune ever to see an escutcheon of the full size given in Guenon's books. In my book I have reproduced the drawing of the escutcheon of the bull. It is always very much smaller in the male than it is in the female; and I find that the prevailing one is the curved-line escutcheon, which is a very excellent one. You will always see the escutcheon on a bull, if he has it, as plainly as you will on a cow. You will see it if it is there; but you will not see it as large as on the cow. Guenon,

while he defines ten classes in cows, gives only three grades or classes to bulls, — good reproducers, bad, and indifferent. The indifferent he thinks are not worth raising.

QUESTION. My point is, What is the appearance and size of the perfect escutcheon on the male animal?

Mr. HAZARD. I should suppose, if you could find an escutcheon of about one-third the size of those on the diagrams of the cows, you would have a pretty good bull. You can discover the escutcheon on the calf, strange to say, as a fœtus seven months old, better than you can three months after it is born; but we do not often have an opportunity to examine it in that condition, and do not want to. I have heard it said that some can see the escutcheon on a calf when it is born. I have never been able to do it, although I have tried to do it often. I have seen certain indications on a calf six weeks old, that that calf had better be kept, instead of selling it to the butcher. I would not undertake to judge of any escutcheon under three months; but it would pay any man to keep a calf three months before determining whether to send it to the shambles or not.

Mr. EVERETT. I believe you stated the time that a cow should go dry. How long should a cow have rest?

Mr. HAZARD. I think every cow ought to have a rest of from four to six weeks.

Mr. EVERETT. Any cow, no matter what her weight is, or what her qualities are, ought to go dry as long as that?

Mr. HAZARD. I think so. A cow is a machine. We put the food into it, and it converts that food into milk and flesh. But we must not keep the machine running all the time: we must oil it, you know.

QUESTION. Is the skin under the escutcheon more soft and oily than any other part?

Mr. HAZARD. Very much more so.

QUESTION. Do you find an indication as to the length of time a cow will give milk in the vertical escutcheon?

Mr. HAZARD. In the vertical escutcheon, mostly. That is shown by the way in which they rapidly fall off from the first order to the fourth, fifth, and sixth.

QUESTION. But sometimes, in the Flanders, don't you find a very good vertical escutcheon, and one not so good on the thighs?

Mr. HAZARD. Yes, sir; and generally you will find that they are broader on the vertical escutcheon. Where they fall off in the thigh-escutcheon, generally the vertical takes it up. In the Flanders you will oftentimes see that one is widened in proportion as the other is narrowed. That is one of the peculiarities of that breed.

QUESTION. To what order should you say such an escutcheon as you have described belonged?

Mr. HAZARD. If she had the ovals, I should call her first-class. If she had not the ovals, I should call her second-class. If she had but one oval, she would be a decent cow.

Mr. EVERETT. What percentage of cows would have a first-class escutcheon?

Mr. HAZARD. I don't think ten per cent would have it. They are very rare. I suppose really not more than five per cent.

QUESTION. Did you ever find a good cow without a good escutcheon?

Mr. HAZARD. No, sir: I never have seen one. I have heard there are such, but I would go a good distance to see them. Wherever I have seen a good cow, I have found she had a good escutcheon.

Dr. WAKEFIELD. Suppose you have a cow with a narrow escutcheon on the thighs, running up a wide vertical escutcheon, indicating that she would give milk longer than others, may not such a cow, in the main, be as good as a cow that is cut off earlier, but gives more at the time when she first calves?

Mr. HAZARD. People have different views about that. The theory of the Darlington brothers is, that, if cows are going to give so many quarts in a year, they had better do it in four or five months, and then go dry, because, while they are making their butter, they feed very heavily; and the argument is, that it is cheaper to have a cow of that character than one that gives milk during a longer period. We will say that a cow is going to give three thousand quarts of milk. They argue that it is better to have her give the three thousand quarts in five months, rather than eight or nine, because they have got to keep her running so much longer to get the same amount.

Dr. WAKEFIELD. Suppose you find a cow that gives milk

the year round, or almost the year round, it would have an escutcheon that runs higher?

Mr. Hazard. Yes, sir; the higher and broader, the better.

Dr. Wakefield. I should like a cow that would give a large amount of milk all the time; and, if I am looking for that, may I not expect, when I find a cow that has a narrower escutcheon on the thighs, and wider on the vertical, that I have found one that will make milk much longer?

Mr. Hazard. A cow will give much more milk in a year that is of that shape.

Question. The gentleman, I suppose, has great confidence in this escutcheon when it comes up to number one. Would he consider it a safe criterion to go by in buying? Would he be willing to buy a cow with no other good marks?

Mr. Hazard. I would not. I don't think, since God has given us five or six other points to go by, that we should disregard those, and rely entirely on the escutcheon. If you are selecting a cow, you must not say, "Oh, there is a Flanders escutcheon, I will buy that cow." You must go and examine her, and see whether she has a fine skin and fine hair, and see if she is all right. The escutcheon must be accompanied by the other marks of a good cow. Guenon does not pretend to say, that, because a cow has the escutcheon, she is first-class. He simply says, if she has that, accompanied with some other marks, she is a first-class cow. It does not follow, because a cow has a good escutcheon, that she is a desirable animal. She may have been injured in some way. I will tell you an instance of that. I was examining a herd of sixteen Devons, and as I was passing along the stalls, seeing the posteriors of the animals only, I stopped by the side of one cow, and said to the owner, "Doctor, here is a cow you ought not to have in your herd." — "What is the matter?" said he. I said, "She is part bastard." He says, "That is one of my best cows." — "You are very much mistaken," said I. "You had better test that cow. I think you are wrong about it." Said he, "Why?" I showed him the bastard-mark. Then he asked me, "How much milk does she give?" I replied, "Eight quarts." He said, "She is a sixteen-quart cow. You are much mistaken about it." Finally he said, "To tell you the truth, that used to be my

best cow; but she failed in her two forward teats, and now she gives only eight quarts." He had her brought out, and I examined her. I said, "That accounts for her only giving eight quarts." Half her bag was gone. A very interesting query them rose in my mind. Was this bastard-mark developed by the accident to this animal? Here was a cow that had given sixteen quarts, and had fallen off to eight. I knew nothing about it. I only examined the posteriors of the animals as I went along from row to row. He did not know any thing about the bastard-mark; had never watched it, and did not know any thing about it.

QUESTION. What do you think about it?

Mr. HAZARD. Well, sir, I should not be surprised if it was. I should rather think it was. But then my wish might be father to the thought. You know I have a hobby to ride about the escutcheon. I might say that that is the natural explanation of it, and some people might say that I was riding a hobby, and it may be so; but, in my judgment, I think it was.

Mr. WARE. How did it appear to you that she gave only eight quarts?

Mr. HAZARD. I thought, although she had a fair-sized bag, it did not appear healthy and vigorous, and I judged something from the yield of that breed in the country where you find it.

Mr. HADWEN. Did you mean to give the doctor to understand that she only gave eight quarts in her full flow?

Mr. HAZARD. Yes, sir. She would rapidly fail.

The Chairman then introduced ARTHUR A. SMITH, Esq., of Coleraine.

SHEEP AND LAMBS.

BY ARTHUR A. SMITH.

Mr. CHAIRMAN,—Permit me to preface this paper with the following ancient testimony in favor of the sheep. So long ago as the year 1534, Fitzherbert, in his "Book of Husbandrie," had this to say in behalf of the sheep.

"A husbande cannot well thryve by his corne without he have other cattell, nor by his cattell without corne. And because that sheepe, in myne opynyon is the mooste profytablest cattell that any man can have; therefore I pourpose to speake fyrst of shepe."

What was true then is also true at the present time, wherever the necessary appliances are at hand.

There is no industry that attracts the attention of the citizen not immediately engaged in it as does sheep husbandry. The reason for this is obvious, inasmuch as the question of food and raiment enters into its consideration. People eat mutton from choice; while men wear woollen clothes from necessity: consequently every thoughtful person is interested in having the very best mutton and wool at the very lowest possible price.

I shall therefore, in the short time allotted to me, give my opinion (based in part upon my own experience) as to the best kind of sheep for the farmers in this vicinity to breed for wool and mutton, also to give the experience of some very successful farmers in the raising of early or meal lambs for market.

I know, that, at the present time, there is a heated discussion going on, engaged in, by the friends of the different breeds; viz., the long-wools, embracing the varieties of Cotswolds, Leicesters, and Lincoln; the middle-wools, embracing the varieties sometimes called "Downs," or Southdown, Hampshiredown, Oxfordshiredown, .and Shropshiredown; and fine-wools, embracing the Merinos of the numerous types of the American, French, Spanish, Silesian, and so on. In this discussion I do not propose to take part: they all have their merits.

Having first decided what you desire to accomplish with your flock of sheep, then select the *kind* that will (from the best information you possess) meet your wants. If for wool alone, without regard to mutton, I think the testimony is in favor of Merinos; if for mutton, then the long-wools, any of the varieties. But if you desire to combine the two qualities of producing wool and mutton, then by all means take the middle-wools (the Southdown being foremost in the list); or what is still better in my judgment is to cross fine-wool ewes with a Lincoln, Cotswold, or Leicester ram, thus securing a strong, robust, and hardy constitution with good size, and a grade of wool for which the wool speculators (in this vicinity) will allow you just as much per pound as though it were Combing or Delaine.

I am well aware that it is an absolute necessity to have

the "pure-breds" of all kinds; and, with present indications, it would seem that the United States would, before long, export sheep to Europe for breeding purposes.

Already has Japan, as well as Australia, and some of the countries of South America, ordered cargoes of Merinos. There *never* was a more promising time for sheep-breeders than the present.

Having obtained the cross-breed, then decide whether you will raise early or late lambs. If "early lambs," then cross the Cotswold-Merinos with a pure-bred Southdown ram; but if for late lambs, to sell from grass to the butchers in the months of July and August, or keep for winter feeding, then continue to use a Cotswold ram.

Never allow the lambs to remain with their mothers after August.

I believe that many of our sheep-raisers might attribute their failure in sheep-husbandry to the fact of allowing the lambs to draw from the ewes until the time to put their flocks into winter-quarters, or deliver the lambs to the feeders.

The method of weaning lambs is simple and easy.

Having first secured a good pasture for the lambs, you can get your flock to the barn in the morning, and separate the lambs from the ewes, immediately taking them to the lot assigned, together with a few dry or barren ewes to keep them quiet. Never allow the lambs to suckle the mothers after the first separation, as this only retards the weaning process.

Should the ewes have a large flow of milk, keep them in the barn, or near by; so that their bags can be examined, and, if necessary, the milk drawn therefrom.

If desirable, after two weeks' separation, the ewes and lambs can be turned into the same lot, without any fear of the lambs attempting to suckle the ewes.

I have said that the lambs should be weaned in the month of August, assuming that the lambs were dropped not later than April, or the middle of May. Of course this rule would not apply to those ewes which delight in raising two crops of lambs in a year, the second crop not appearing until about the middle of July.

All of the latter ones should be allowed maternal care until put into winter-quarters.

The raising of late or grass lambs is much more exten-

sively practised than the raising of "early lambs," for the reason, too common, that it is "less work."

Other farmers have large pastures, cut a vast amount of hay, feed their mowlands rather than cut a crop of rowen, which is so essential to the success of the feeder of early lambs.

Without a good crop of nice rowen hay, I should not attempt to keep a nice flock of breeding ewes, much less attempt to raise early lambs for market.

I now propose to give you an account of the manner in which most of our successful feeders fatten their sheep for market.

If the feeding sheep consist of "spring lambs," they are put into the pens about the 1st of November, and commence to feed with a light allowance of corn and oats, with a little cotton-seed meal mixed. This feed is given the first thing in the morning, then a ration of good early-cut hay, fine or rowen, followed with a feed of coarser hay or straw at or near noon.

The sheep should be left to themselves after their last feed, unmolested by any one. Do not allow any one to visit the pens while the sheep are resting between their feeds.

There is nothing that will so much prevent a sheep from laying on fat as to behold a strange man, with a huge buffalo, wolf, or bearskin overcoat upon him, walking to and fro in front of their pens. And I may say, that, among our successful feeders, the practice of allowing any one to visit the sheep-pens during the interim between feeds disappeared at about the same time that they made the feeding of sheep a success.

Let the sheep rest until about four P.M., when they will go quietly to the barn. Clean the racks of the coarse hay or straw, giving the sheep a good bed, and then feed with grain, as in the morning, following with a good feed of fine hay or rowen. Shut your barn, and leave them for the night.

The amount of grain should be increased as you advance in feeding, until they will eat one quart each of half corn and half cotton-seed meal mixed, at which point I should stop increasing the amount of grain, but give them a few turnips every day, and, if turnips are not at hand, then give them mangolds, beets, or potatoes.

Pure running water should always be accessible to the

sheep: do not depend on cisterns, pails, or snow. I have seen, as no doubt all of you who have fed sheep have witnessed many times, the sheep leave their grain, and visit the watering-trough, drink of the pure water, and then return to their feed again; but you never saw them leave their grain for the purpose of eating snow, or drinking from a bucket or tank of water that is only replenished once in twenty-four hours. Secure running water for your sheep if possible, although they may *survive* if they have plenty of snow to eat.

Sheep need good air, and not too many together, to do well. I would not have more than twenty-five or thirty in a lot for feeding, and those very nearly of the same grade and size. Keep them "high and dry," even if a little cold, rather than low, damp, and close, though warm. In the former case you will not discover any of the diseases to which sheep are incident; while in the latter you will be troubled before spring with a large number of pelts without the carcasses.

What I have said has been applied to the feeding of spring lambs. The same rules, however, will apply to the feeding of older sheep; and, with the following rules to govern you, success must surely attend your efforts.

1st, Raise your sheep for feeding, if possible; otherwise purchase direct of those who do raise them. If you have not judgment sufficient to buy your sheep, you had better keep out of the business of feeding.

2d, Be regular and systematic in your feeding, and raise what corn, hay, and roots you feed to them.

3d, Sell your sheep as near as you can to those who consume them, thereby saving to yourself from ten to one hundred per cent of the profits that otherwise go to the middle-men and speculators.

Permit me to digress a little from my subject proper, sufficiently to state that the time has passed when the feeders of sheep in this vicinity *are obliged* to sell their flocks to the middle-men, or not at all. Thanks to a higher standard of farming, with more independence and intelligence! The feeder of sheep can take his car-loads to Union Market, and sell them to the butchers there for their value, just as well as anybody outside; and the cry that the sheep-trade is controlled by one man, or a set of men, is a delusion, a subterfuge, a part of the game to suck from you, brother-farmers

and feeders, the very profits to which you are entitled for your labor of care and toil. I know whereof I affirm, and can cite numerous instances where it has been practically demonstrated.

Farmers, let us be men, and no longer allow ourselves to be *duped* and deceived by this middle class, who delight so much in boasting of their wealth obtained by sucking at our vitals.

Co-operation is the plan that will save us, as it has saved others. It is also alleged that the farmers cannot afford to consign their stock to the Boston butchers to be sold on commission; but this, too, comes from the same class of speculators. I will simply say, that, wherever and whenever it has been tried, it has effected grand results.

I will now give the statement of a farmer in the county of Franklin, who has the ability (like many farmers in the county), and is not afraid, to go to Albany or Michigan, and purchase his sheep, and, after *feeding* them, take them to Boston and sell them. He says, —

In 1868 my sheep cost in Albany	$.07 per pound.
Weighed $116\frac{3}{7}\frac{3}{7}$ pounds per head, cost . . .	8.15
Expense carrying home, and to Boston, per head .	.40
Entire cost of sheep per head	8.55
Commenced feeding the 20th of January, and sold May 4: time of feeding	102 days.
Sold sheep at	.11 per pound.
Weight of sheep per head	135 pounds.
Amount received per head	$14.85
Received for feeding per head	6.30
Gain per head (almost)	19 pounds.
Amount of corn consumed per head	2 bushels.
Corn was worth per bushel	$1.38
Cost of grain per head	2.76
Leaving, for care and hay, per head . . .	3.54

He further states, that in 1869 he fed lambs, and received for feeding per head $3.03. The amount $3.03 is what he received in Boston market more per head than the lambs cost him there, or, in other words, is what he received for his hay and grain per head. This is but one of many statements which I have received from the feeders of sheep in Western Massachusetts; and nearly all add, that they believe there is a larger profit in feeding sheep than any other stock, — if a flock is rightly managed, — and with immensely less labor.

I desire to give some statements, obtained from reliable feeders and *honest men*, as to the increase in weight of lambs in a specified time.

I will give the statement of a farmer who believes in what is called the "Strap-leaf Turnip (a specimen of which is on exhibition) for fattening sheep, based upon his personal experience. He says, —

"In November, 1877, I had a spring lamb that weighed, when I put it up to feed, on or about the middle of the month, ninety pounds. I fed it all the rowen it wanted, and on full feed. It eat one quart of corn-cob meal, with two quarts of turnips, per day, never more than that amount; and on the eleventh day of March, 1878, it was taken to market, and, after being carried five miles in a wagon, it weighed one hundred and forty-one (141) pounds, a gain of fifty one (51) pounds in one hundred and sixteen (116) days."

The same farmer is feeding a lot of lambs at the present time, and in the same manner, and I dare say with the same results.

I will also give you a minute statement of the gain of eighteen lambs, fed by Mr. C. T. Alvord of Wilmington, Vt.

WEIGHT OF EIGHTEEN LAMBS NOV. 26, 1878, SIX DAYS AFTER THEY WERE PUT INTO THE BARN.	LBS.
No. 1	95
No. 2	99
No. 3	87
No. 4	84
No. 5	72
No. 6	64
No. 7	74
No. 8	66
No. 9	68
No. 10	76
No. 11	72
No. 12	75
No. 13	105
No. 14	66
No. 15	85
No. 16	78
No. 17	76
No. 18	92
	1,434

WEIGHT OF THE SAME EIGHTEEN LAMBS, SOLD MAY 13, 1879.	LBS.
No. 1	133
No. 2	178
No. 3	137
No. 4	128
No. 5	139
No. 6	146
No. 7	135
No. 8	102
No. 9	130
No. 10	123
No. 11	104
No. 12	111
No. 13	132
No. 14	126
No. 15	100
No. 16	114
No. 17	130
No. 18	116
	2,284
Less tare	10
	2,274

Time of feeding	168 days.
Whole gain	840 pounds.
Greatest gain per head	79 pounds
Smallest gain per head	15 pounds.
The average live-weight at commencement of feeding . . .	79$\frac{3}{5}$ pounds.
The greatest gain of any single lamb per day	7$\frac{1}{2}$ ounces.
The average gain per head	46$\frac{2}{3}$ pounds.
The daily gain per head	4$\frac{4}{9}$ ounces.
The average weight at time of sale	126$\frac{1}{3}$ pounds.

"These lambs were taken to the Boston market, having been driven thirty miles, and then *carred* a hundred miles; and their shrinkage in weight at Boston, as compared with their weight in their pen, was an average of only ten pounds, and they were sold for eight cents and a half per pound, live-weight.

"These lambs were fed with rowen hay three times each day, with *rutabagas* once a day, and corn once a day. The turnips were fed in the morning, *after* they were fed with hay, and the corn at night, *before* the hay was fed. They were fed only what they would eat up clean every time; and I think that they would have eaten more turnips and corn than they did, if I had given them more. When they first came to the barn, I began to feed them turnips, and, after they would eat them well, then commenced feeding a little corn. After that, the quantity of turnips and corn was gradually increased from week to week. For the last two months they were fed one bushel of cut turnips each day, and the last three weeks a half-bushel of corn per day. The whole amount of corn fed to them was thirty-six bushels.

"The amount of turnips fed to them I cannot give, as no account was kept of them. They had access to water every day, and were fed salt once each week.

"They were fed with the different kinds of feed *every* day, and as near as could be at the *same hour* of the day."

I will now give you the statement of a farmer in the town of Coleraine, as to the product of a single sheep in eleven years: —

This sheep is a cross between the French Merino and Southdown. She has dropped ten lambs, all of which have been sold at an average price of seven dollars and eleven cents per head. Total amount received for lambs, all of which were *grass lambs*	\$71 10
The first five years she sheared an average of seven pounds of washed wool per year, and the remaining six years she sheared an average of five pounds of washed wool per year. All the wool has been sold at an average price of thirty-five cents per pound, making total amount received for wool (65 pounds at \$.35)	22 75
Total amount received for wool and lambs	\$93 85

"The sheep at the present time is in good condition; weighs ninety-seven pounds and a half, and has good teeth, every tooth being perfect. Her last lamb was dropped the second day of May last, by Cotswold ram, and, when four months old, weighed ninety-seven pounds and a half; at five months, weighed a hundred and seventeen pounds and a half; and at six months old it weighed a hundred and twenty-seven pounds, — without grain.

"This lamb was sold to Capt. Fellows of Shelburne, Mass., the veteran sheep-feeder in this vicinity, for eight dollars."

I have another farmer in mind who has a very prolific sheep; and the statement which he gives shows how very quickly one can, with the right kind of a sheep, raise a flock. He says, —

"I have a sheep that is three years old. When one year old, she dropped a ewe-lamb; at two years old, she dropped two ewe-lambs; and at three years old, or last spring, she dropped two lambs, — one ewe and one ram lamb. The first ewe-lamb dropped a ewe-lamb when she was two years old, or last spring; and the next two lambs, at one year old, each dropped two ewe-lambs, making, in a period of three years, including the mother of all, a flock of eleven sheep. Her breed is Southdown. She is nearly pure-bred, and was herself a *twin-lamb*."

I am of the opinion that late feeding is more profitable to the feeder than early. The markets for the past few years have been decidedly better, and then it affords the feeder an opportunity to retain the fleeces of wool, that bring more money from our local wool speculators than the pelts will bring in market with the wool on. This is very strange, yet true, and should be corrected in some way.

Mr. Henry B. Goodnough of Boston, one of the largest butchers of sheep and lambs in that city, in answer to some questions which I asked him, writes as follows: —

"About the class of sheep for farmers to feed, it would depend somewhat how they could be bought in the fall; but, as a general rule, the *best* sheep are the most profitable to feed. A very good class of sheep to feed would be small fine-wool lambs, or half-bloods, either ewes or wethers, and feed them until June. Shear them about the 1st of May, and then feed them high. They will gain very fast, and will readily bring a good price. Such lambs can usually be bought low in the fall, and it will not take as much to feed them as larger sheep; and the prices per pound are higher on such classes of sheep, if well fed."

The *feeder* with his two hundred or five hundred big fat wethers is sure of getting for the dirty, greasy wool

within eight cents per pound as much as the farmer who takes the greatest pains in washing his sheep, and preparing the wool for market; and, in view of this fact, many of our sheep-raisers have adopted the plan of shearing before turning their sheep to pasture in the spring, having become satisfied that they receive more money for their wool per head than when washing and preparing their wool in the "good old way." There evidently is a *premium* offered for *filth* in this particular, which the farmer who keeps his sheep saturated during the winter (much to their discomfort) wins; and I can but enter my protest here against the manner in which some of our farmers dispose of their annual clips of wool as tending to lower the standard of wool-raisers. Under the present system the wool is sold before it is taken from the sheep (unless, perchance, one is sheared in January), a certain price agreed upon, and "more, if others pay more." Under these conditions the farmer promises his wool, and so on to the next neighbor, who is informed by the speculator, that he has purchased Mr. A's wool, and you can have the same, shall I have the promise of yours? The answer is in the affirmative. The condition of the wool is not known by either party to the arrangement.

Now, the farmer who refuses to sell his wool until it is ready for the market, and in good condition, of course gets a much higher price for his wool, and so forces No. 1 buyer, under the terms of the contract, to pay much more for the lots engaged by him than he expected, and more than they are actually worth, having, in the former cases, been very improperly prepared for market. A wool-buyer should not be allowed in a sheep community until the wool is taken off and prepared for market, and then, not unless he will buy the wool upon its merits, paying for Mr. A's wool (that is prepared in first-rate order, and is of a very long staple, suitable for combing) more than he pays Mr. B for his lot of wool, that is dirty, ragged, and out of condition throughout, although claimed to have been well washed. Farmers are, like all other classes, human; and strict honesty, neatness, and their efforts to bring their pursuit to a higher plane in all its branches, should be encouraged. I speak of the wool-business to show that too often the *good* wool sells the wool that is too poor to sell itself, and the remedy is this.

Farmers, whatever your products are, know yourselves what they are worth in the markets, and then demand it of whoever buys them.

Having spoken of the feeding and marketing of sheep, I will now state briefly the manner pursued by many of our farmers in raising, fattening, and marketing of "early lambs." And let me here state that nearly all of the early lambs that supply the Boston market — which is *the* market for such lambs — are raised and fattened in Franklin County and towns adjoining.

The Boston butchers say to me, that in Vermont, New Hampshire, and Maine, the farmers have tried, and thus far have tried in vain, to *get up* early lambs that will meet the demands of the class that consume this luxury. They agree with us that it is a *trade;* and but a few have as yet learned it to any thing near perfection. Early lambs (as I use the term) are those lambs that are dropped in December, January, and before the middle of February, and are of such a breed as will, with the very best of care and feed, develop to such an extent that they will be fat enough to weigh, from the middle of April to the last of May, all the way from sixty to ninety pounds, and dress in market fifty per cent of their live-weight.

To many this statement will seem almost incredible; yet it is true. I have known of many instances of lambs at three months' old weighing eighty pounds and upwards.

In order to have lambs develop to such a size, the ewes should not be left to pick their living from the poorest hay in the barn, with nothing to shelter them from the early storms of winter, or protect them from the cold, save an open shed, but should have the best of care from the time they are put into the barn until the lambs are taken to market.

I think I may safely say that success in raising early lambs for market depends as much upon the care of the ewes, both before and after the birth of the lambs, as upon the care of the lambs. The first thing requisite to be done is to procure the right kind of ewes; and the experience of the most successful raisers of early lambs convinces them that a cross between the Merinos and Cotswolds, or other long-wools, is the best, for several reasons.

They are, as a rule, in condition to *couple* earlier in the

season than the coarser grades, and this is a very essential point gained; yet many of our early-lamb raisers, even with this class of ewes, are troubled and seriously annoyed because of their ewes' unwillingness to *couple* earlier in the season. How to overcome this difficulty is a problem which they all would like to have solved. There have been a *great* many theories advanced by a *great* many GREAT men; and all, when put to the test, have proved to be nothing but theories.

I have but one statement to make with reference to this matter of coupling, and that is obtained from one of the most skilful and eminent physicians in this county, and one upon which he is willing to risk his reputation as a physician; viz., "Have your ewes in a good healthy condition, not too fat, and then give them the following prescription: one half-pint of ground oats per head, to which add from one to three grains of hyperphosphate of lime, and within four days' time the great work is accomplished, provided your ram is good for any thing."

Another reason why the class of ewes I spoke of is the best is, that they seldom produce twins, they have better constitutions, are better milkers, and will recuperate quicker after the lambs are taken from them.

With such ewes, and with such care as I have indicated, with a suitable place, there is no necessity for the man who has the care of the sheep to have a watch-meeting every night for fear the little lamb, with the aid of its mother, will not survive.

With good early-cut hay or rowen, and a small feed of oats and roots each day, prior to lambing, you will experience little trouble with your ewes "not owning" their lambs, or a lack of milk to give them strength in this their time of need. As soon as the ewes have recovered, the practice of many is to feed them in the morning with one quart each of mangolds or turnips, and at night one pint of half cotton-seed meal and half corn-cob meal well mixed. The lambs should have a separate apartment from the ewes, where they should be early taught to congregate for the purpose of eating their grain, which should consist of oat and oil meal, or perhaps a little corn-meal mixed, any thing but cotton-seed meal. Do not give cotton-seed meal to your lambs,

only as it comes in the milk from the ewes. I am fully convinced that lambs will fatten faster, and with less grain, when the ewes are fed largely with cotton-seed meal. When the lambs are taught to eat their grain, they should be fed regularly, and no more than they will eat up clean. I do not believe in the idea of having the grain always before them. The lambs should have access to pure water as well as the ewes; and both should have salt so convenient, that they can help themselves whenever they desire. As the lambs grow and develop, they should have a change of feed for a few days, from oil-meal mixed with northern corn-meal to oil-meal and the corn cracked; and then, again, give them rye unground; but seldom, if ever, give up the oil-meal. Be sure and have that the basis of the grain with which you feed your lambs, and, with a little change in your other grains, you will prevent sickness, followed almost always with death, and this, too, of your best lambs. Giving the lambs a daily feed of potatoes also is an excellent thing.

Have every thing neat and clean about your sheepfold, with good ventilation, yet warm in winter, and cool as the warm spring weather approaches, and, with a love for the business, you will surely succeed, receiving better pay for the time spent, the hay and grain given to both sheep and lambs, than you can in any other possible way, dairying not excepted. You ask me to give you some figures, and that is what I now propose to do.

Any farmer who has the "trade" learned can safely rely on the following figures: —

Fifty suitable ewes for raising early lambs are worth, at time of putting into winter-quarters, at present prices, $5 per head, or	$250 00
Value of *extra* feed for the ewes that are to lamb early, $1 per head, or	50 00
Value of feed for lambs, including rowen, grain, and roots, at present price $2.50, or	125 00
Total expense	$425 00

RETURNS.

Fifty ewes are worth as much by the last of May, when the lambs should all be sold, as when put into winter-quarters, viz., $5, or	$250 00

Fifty lambs that are ready for market from the middle of April to the first of June, and will average sixty pounds, will bring in Boston market, according to last spring's prices, an average of $9 per head, or	$450 00
Deduct from this $1 per head for transportation, and commissions for butchering and selling, and you have the sum of $8 per head, or	400 00
Total value of sheep and lambs	650 00
Total cost, including every thing	425 00
Leaving for your care of fifty ewes and lambs, besides the manure, which is very valuable	225 00

I have in this statement allowed for *extra* feed for the ewes one dollar per head. I believe that this amount is not enough, if we compare the manner in which many of our farmers feed their ewes which are to lamb in April and May, with the feed that should be given to the ewes that raise the early lambs; but, treating the two lots as they should be, I think the amount not too much for the extra feed.

The above figures are based upon the fact that the lambs are dropped in December, January, and before the middle of February, and that *some* of the lambs are ready for market on "Easter" week, and perhaps some are ordered in the month of March. I received for a lamb last March, that dressed only twenty-three pounds in Boston, and was not as fat as lambs should be, ten dollars; and I know of other parties that received sixteen dollars for some fine lambs in the same month; yet the market for early lambs begins about "Easter" week; and fortunate is the farmer who has so managed, that a portion of his lambs are ready to ship at that time. I am informed by those butchers who handle the early lambs in Boston market, that the prices have not changed very much from one year to another for the past five years; that the consumers of this luxury are abundantly able, willing, and *expect* to pay for it.

I will now state briefly the manner in which our early lambs have been marketed. I think I am right in stating that a very large proportion of the early lambs raised and fattened in this vicinity, and in fact all that have gone to the Boston market, have been slaughtered and sold on commission. This has seemed a necessity, for the reason that the butchers would not purchase the lambs on foot, the market not yet being fully established, and they cannot with any

certainty tell how many they can dispose of within a specified time. I know of some feeders of early lambs who practise slaughtering their own lambs, and sending the carcasses direct to the consumers, and with much larger returns.

Could this be the practice of all, I think it would result in saving to the producer two commissions at least: first, the one to the purchaser of the lambs from the feeder; and, second, the commissions to the butchers for slaughtering, and selling to the consumers.

What reason is there why we should not at least have the same advantages for disposing of our lambs as the dairymen have their butter and cheese? I believe it to be perfectly practicable for the producers of early lambs to slaughter them, and send the carcasses to A, B, and C, in Quincy-hall Market, the pelts and refuse which they save to themselves fully paying for the trouble of slaughtering, and expense of transportation. Is it not time for us as farmers to begin to "rake after," and save all we can, and thus make *our* calling one that is strictly independent? The great trouble is, we support too many that are not of us, and consequently are against our best interests. I believe the time is near at hand when the producer and consumer will be directly connected, and thus be mutually benefited. Hoping that I have in this paper suggested some ideas that will lead to a profitable discussion, I leave the subject with you.

The CHAIRMAN. Gentlemen, the subject is now open for discussion, if any gentleman wishes to make any remarks upon it.

Mr. WHITAKER. I have bought a good deal of wool. The gentleman referred to the difficulty of buying wool. The great difficulty about the buying of wool is with the farmer. In nine cases out of ten, probably, if there was any trouble, it would be the farmer's fault. If I come into Franklin County or into Greenfield to buy wool, I buy the first quality wool, and pay the farmer the highest price. He is so well pleased because he gets an extra price for his wool, that he must tell everybody about it. It is one of the most difficult things in the world to make one farmer believe that his wool is not worth just as much as his neighbor's. By paying a certain price, the wool-buyer

almost invariably makes the price for all the wool in that neighborhood; and consequently the difficulty has been in going around, and buying every man's wool fairly and squarely on its own merits. Now, if the individual farmers in a place would come together and settle upon some reliable person who should fix the value of their wool, there would be less difficulty, and less fooling, and less cheating, about buying wool; but, as long as the matter stands as it does, there will always be this difficulty. The attempt will always be made to put you all on a horizontal line.

There are three fleeces lying there on that table, of three distinct qualities; and one man, perhaps, will have twenty or thirty sheep, out of a flock of a hundred, of one kind, and another number of another kind, and another number of still another kind. When the wool-buyer comes to buy that wool, it is all mixed up, and he has the greatest difficulty in getting at its value, because there are so many different kinds, and each one has a different value. We have to buy your wool as it is, and we have to estimate it. You don't want to say that you have got ten or fifteen oily sheep in your flock, whose wool is not worth so much by certainly ten cents a pound as the wool of some of the others. There comes the difficulty. When you are breeding full-blood Merinos, or full-blood Saxony sheep, you have pretty near an even thing; but, when you are breeding cross-bred sheep, it is a very different thing. I have seen a Merino crossed with a Leicester that produced as short a staple as the Merino, with as coarse fibre as the Leicester: there you have a wool that is almost worthless. Another one has the length of the Leicester and the fineness of the Merino: there you have a wool that is worth more than double what the other is worth.

In this matter of raising sheep for wool, you have a most difficult thing to manage, from the fact that you are dealing with the coat of the animal, and not with the animal itself. All the value of the animal depends upon its coat. The second fleece from a Saxony is worth more than the first: every other kind of fleece is worth the most the first year.

Now, there is one peculiarity in regard to the value of wool, and it has existed almost ever since the war: it is this, that a medium fleece is worth more than the fleece of a

full-blood Merino, from the fact that it shrinks less, and from the further fact that it is the fashion to wear coarser cloth than in former times. There are very few men in this assembly who have fine broadcloth coats on. Almost every coat you see is made from a coarse-woolled sheep. Sometimes fashion makes a great deal of difference with regard to the value of wool. Our friend, speaking of combing-wool, classed the Leicester and Cotswold as combing-wool. The improved Southdown is also combing. A long-woolled sheep crossed with a Merino produces a wool to-day which is more valuable than the wool from a Cotswold or Leicester. Formerly, long-woolled fleeces brought the highest price, from the fact that a lustre wool was wanted to imitate that class of goods which the ladies used to wear so much, alpacas; for you all understand that there were ten times as many goods sold in the New-York market under the name of "alpaca" as there was alpaca wool in the world to make them from. The greatest part of these goods was made from long wool. I have been into Canada, and bought combing-wool that cost seventy cents a pound laid down here, where a cross-breed of wool like this on the stand would not have brought fifty cents. To-day those two cross-bred fleeces would bring more in Boston market than any full-blood fleece you could take there. A great many years ago I combed the finest Saxony wool by hand, for which I received fifty cents a pound simply for the labor I put into it. That wool now can be combed for about a cent a pound.

In regard to what the gentleman said about buying wool on the sheep's back, that is an undesirable thing. It acts more favorably to the seller than the buyer. I remember buying one year a large amount of wool on the sheep's backs; and, when it was delivered, it was worth a hundred thousand dollars more than I paid for it. That was owing to the fact that it began to go up before shearing, and continued to go up: consequently, there seemed to be safety in that. But it left the buyer at the mercy of the farmer. He could put his dead wool into his fleeces, or any thing else. It may not be pleasant for farmers to hear such a statement; but there are unpleasant things that we hear sometimes, and sometimes the truest are the hardest to bear.

In buying wool, particularly in some sections of the coun-

try, the purchaser encounters one very bad thing, and that is this: all the wool that is pulled from the pelts of sheep that die in the winter is stuck inside of the fleeces, and the buyer has to pay full price for that when it is not worth one-half what the outside might be. In buying wool, you cannot look at every fleece, and you have to trust to the honesty of the farmer in that respect, and I must needs say that you sometimes feel that you are not getting what you bought. And here is the difficulty when you buy wool on the sheep's back. The buyer, whoever he is, who buys his wool in that way, must not complain if he is cheated, because he buys the wool on the sheep's back.

I said a moment ago, that one year, the wool I bought was worth a hundred thousand dollars more than I paid for it before it was shipped east. The following year, another person went and bought wool in the same way, and his wool was worth a hundred thousand dollars less than what was paid for it. This, you must remember, is a game that two can play at. It is simply a matter of speculation, and we all play at it to a greater or less extent; and, if we would not get bit, we must not play. Now, my friend Mr. Smith, last year, would have done well if he had not bought any wool at all: this year he would have done ten times better if he had bought all the wool he bought on the sheep's backs. That is the difference. Wool this year has been going up from the very day it was taken off the sheep's back. Thousands and thousands of pounds were bought on the sheep's backs, and a great deal of money made out of it; and if the same men play the same game next year, and buy wool on the sheep's backs, they will lose fully as much as they made this year. This thing is equalized one way or another. When we have so far progressed that we can get a perfect cow, a perfect breed of sheep, a perfect man, and a perfect woman, we can safely trust one another; but, until such time as we do that, we shall be continually making mistakes in buying and selling.

If I were keeping sheep, and raising wool, I would find out as near as I could what was likely to be wanted in the market; and, when I had ascertained that, I would try and raise it. If you are going to raise and keep long-woolled sheep, I want you to bear one thing in mind: Forget every thing

about wool, don't let that trouble you at all; but feed your sheep well, keep them right up, and you will surely come out well. I can take a fleece of wool, and pick a staple out of that fleece; and if that sheep has varied in condition, if it has varied in its feed to any considerable extent, I will tell you very near where that occurred and when it occurred.

I have seen a lot of wool from a flock of sheep that had been driven from Ohio into Illinois; and, when I examined that wool, I was surprised to find that every staple in the whole of those fleeces broke in a certain place. The upper part of that staple was plump, full, and soft: the lower part of it was thin and wiry. I called the attention of the owner of the wool to that fact. "Well," he says, "I didn't suppose you would find that out." I said, "Find what out? All I have found out is this, that the upper part of the wool was grown on an entirely different pasture from the lower part of it." — "Well," he says, "you have found it out. These sheep last fall were driven from Ohio to Illinois. They passed from a soft, fine pasture in Ohio, to a coarse, wiry pasture in Illinois." You know the kind of grass they have in Illinois: it is rough and coarse, and that wool partook somewhat of the character of the pasture.

I was buying wool at a factory, and a person came with his wool; and among the rest he had a ram's fleece. I looked the wool over, and threw out the ram's fleece. I said, "I don't want that: I would rather you would take it back." — "Why," said he, "that is the best fleece I have got. I paid something like fifty dollars for that ram in Canada." I said, "I know it, and I will tell you what you did with that ram. You had paid a big price for him, and you were so anxious to get your money back, that you not only let him serve your own flock, but everybody's else sheep that came around, and you came near killing him; and there is the place on the wool where that occurred." After the ram had served the sheep, the owner began to feed him better, and then the wool started to grow again. There was one kind of wool at one end of the staple, and another at the other, and cotted between. As soon as I told him what he had been doing, he said, "I should like to know how you found it out." I told him.

You can by good feed increase the weight of wool on

long-woolled sheep. We all know we can increase the crops in our fields by putting on manure, and we can increase the weight of wool by the way we feed. I have seen the weight of a fleece increased two pounds by liberal feeding. The wool will not only be longer; but the staple will be better, and be worth more. Here is one man who has been feeding his sheep well, and another man who has not fed his nearly as well. It would be difficult for me to convince the latter that his wool is not worth so much by ten cents a pound as the other man's wool, and does not weigh so much by two pounds to a fleece; but such is the fact. That is the difference in feeding.

We are an agricultural country, and yet we do not raise nearly enough wool to supply our own factories. We are sending corn abroad to pay for the wool we use. We might as well raise the wool in this country, and keep our corn at home, and then we should not be dependent upon the foreign market to buy so much of our corn and butter. We might just as well convert our corn into wools, and save the transportation both ways. We should want more than three times the quantity of wool we have now, and more than four times the number of sheep, in all probability. The same remark applies to sugar. We can raise sugar from beets, and keep the money at home that now goes to foreign countries for the sugar we consume.

Adjourned to two o'clock.

Afternoon Session.

The closing session of the Board was opened at two o'clock by an address from Professor Goessmann of the Agricultural College.

THE RELATIVE VALUE OF SEVERAL VARIETIES OF CORN FOR FEEDING PURPOSES.

BY C. A. GOESSMANN.

Gentlemen, — Before entering upon a discussion of the results of my chemical examination into the composition and the relative feeding value of some of our more promi-

nent varieties of Indian corn (maize), it may be interesting to give, as a matter of introduction, a brief historical review of the circumstances which have exerted a controlling influence on the development of our present opinion concerning the requirements of a rational and economical mode of feeding our live-stock on the farm.

The first successful attempts to inquire into the chemical relations which exist between animal life and animal food are duly conceded to the distinguished French chemist, Lavoisier, in 1780. He taught us the use of the balance in chemical investigations, and thereby enabled us to secure exact numerical values, fit for a comparative study. He began to inquire into the elementary composition of various animal and vegetable substances; and he is the first scientific investigator who expressed the opinion, based upon actual experimental observation, that one of the principal causes of the decomposition of the constituents of the animal organism consists in a slow process of combustion by the aid and at the expense of the oxygen of the air. Sir Humphry Davy and others, eminent in their devotion to chemistry and physiology, soon followed him in this new field of research. Within the succeeding fifty years, much valuable material accumulated; and many of our prominent farm-crops were tested with reference to the relative amount of their proximate constituents, as fat, starch, cellular matter, mineral constituents, &c.

Several circumstances, however, conspired to render the scientific work at that stage of inquiry of but little practical value to agriculturists. The great majority of farmers did not yet realize the want of a more thorough study of the food question in the interest of economy. To raise and to feed stock for the meat-market and the dairy-industry offered but little encouragement for investment. It still remained to be shown more conclusively that raising and feeding stock for both purposes might be carried on more generally, as remunerative special branches of agricultural industry, without having an extensive area of natural grass-lands or pastures as an unfailing resource of fodder. The increasing scarcity of fodder, which was more and more felt from year to year as a natural result of the then ruling three-field farm-management, with its limited variety

of crops, — winter and summer grain alternating with fallow, — rendered it advisable to assign to stock-feeding, as a farm industry, rather a subordinate position: there was, in fact, but little use for scientific aid in making up fodder-recipes, as long as grass or hay, straw, and a few varieties of grain, represented the entire stock of fodder.

On the other hand, analytical chemistry being still in its infancy, and its modes of operation, consequently, open to serious criticism, did not discriminate enough among the various constituents of plants to carry conviction; whilst a too exclusive chemical treatment of the question, "What constitutes the peculiar value of the several articles of animal food?" met with but little support in practice. The customary practice of chemists during the early period of the present century, to ascribe to all the various soluble organic constituents of plants an *equal* value in the animal economy, and to determine their relative merits as food merely by summing up the quantities of their soluble proximate constituents as starch, sugar, fat, nitrogenous matter, &c., resulted in a classification which proved, when tested on the farm, seriously deficient.

Boussingault was the first chemist who advocated (1836–38) a valuation of the food, based on its relative amount of *nitrogen*, assuming at the same time that the entire amount of nitrogen found was present in the form of so-called proteine, or nitrogenous matter. Liebig soon after followed with his classification of the constituents of vegetable and animal food into *plastic* and *respiratory* substances. The publications of both investigators, beginning about the year 1836, and extending over a series of years, mark a new era in the history of the science of stock-feeding.

Whilst Liebig turned his eminent talents to account to inquire into the composition of the liquid and solid constituents of the animal organism, the chemistry of digestion, the composition of animal and vegetable food, and their relation to the support of animal life, &c., to furnish suitable material for the development of an animal chemistry and physiology, which he considered indispensable guides in farm practice, Boussingault engaged, in 1836, in actual experiments upon his celebrated Experiment Station at Bechelbronn, in the Alsace, to test the efficiency of his *fodder*

rations based on *chemical analysis*, and this is the *first* observation of that kind. His tables containing the composition of agricultural fodder-crops were the first and most complete of the time: they referred, however, merely to the percentage of water, nitrogen, and ash. Lawes and Gilbert entered upon their extensive and interesting course of experiments with stock-feeding at Rothamsted, near London, about twelve years later, in 1848. Emil Wolff began the succeeding year, 1849, his investigation, of a similar character, at Möckern, the first agricultural experiment station in Germany.

It is a peculiar circumstance in the history of the science of stock-feeding, that at the very time when Boussingault at Bechelbronn entered upon his previously-mentioned feeding-experiments, and when Liebig at Giessen created a sensation in the scientific world with his comprehensive discussion on the chemistry of food and the relation of the latter to the principal functions in the animal life, leading agriculturists in Germany, in particular, exerted themselves to introduce a *new empirical mode* of classifying the agricultural fodder-crops by recommending a good meadow hay as the standard (=100) for the determination of their relative feeding-value. The amount of any articles of fodder which produced an apparently equal feeding-effect under similar conditions, as one hundred parts of a good hay, or the amount, which, considered from a financial point, produced similar results in the general farm-management, was called its hay-value: in most instances both considerations controlled the decision. The convenience, for the practical farmer, of having assigned to the *different* articles of fodder *one definite relative feeding-value*, could not be denied. And as long as these so-called hay-value tables had no other purpose than to express within a limited territory approximately the relative market-values as compared with hay, they have rendered a good service; but as soon as the attempt was made to turn them to account as a basis for fodder-recipes, or, in other words, whenever their economical value or their market-price was identified with feeding-values or their relative physiological effect, serious disappointments in practice became unavoidable. The circumstance that the *kind* and the *relative amount* of the *different* organic and inorganic substances contained in the various articles of fodder,

in common with the particular degree of the digestibility of each of them, might exert a controlling influence on the final decision regarding the question, "which article of fodder is the most nourishing, and in the end the most economical one," did not yet receive a deserved consideration.

This important oversight in the arrangement of the tables for comparative hay-values became, at first, but little noticeable, on account of the limited choice of fodder-crops characteristic of the then ruling system of cultivation. The change of cultivation, however, from the three-field system to that of the rotation of crops under the leadership of Albrecht Thaer, the father of modern agriculture, rendered the fodder question more complicated. The new system of cultivation favored the raising of a greater variety of fodder-crops. Hoed crops, clover, and other leguminous plants, proved, for various reasons, to be valuable crops in a general farm-management. Their introduction increased in a marked degree the chances of making stock-feeding again a remunerative branch of general agricultural industry without having extensive and good pastures as an unfailing fodder resource at command.

To assign to each new crop, or each new refuse material derived from other branches of industry, a proper position in the current tables of hay-values, presented more difficulty from year to year. Experimenters equally well qualified arrived quite frequently at widely differing results; for instance, one distinguished agriculturist found one hundred pounds of a good hay equal to one hundred and fifty pounds of rye-straw; others, even as high as five hundred pounds of straw; one calls two hundred and twenty pounds of beet-roots equal to one hundred pounds of hay; whilst others consider that amount equal to three hundred and fifty pounds, and even to five hundred pounds of beet-roots. The connection of the names of distinguished agriculturists, as Thaer and others, with the earlier history of hay-value tables, as well as the subsequent exertions of Emil Wolff (1854) and others to save its best feature, i.e., a definite numerical, relative feeding-value for each article of fodder, by proposing to make the *chemical analysis* of a *good average* meadow-hay the *future basis* of a classification of fodder-crops, secured to it a controlling influence on the management of stock-feeding

throughout a large portion of Europe for nearly twenty-five years, — from 1838 to 1862. The use of the tables of hay-values for the compounding of fodder-recipes, outlived all the propositions of chemists of preceding years, and greatly over-shadowed for years the contemporary and really valuable results of careful scientific inquiries at Giessen, Bechelbronn, Rothamsted, Möckern, and elsewhere.

Whilst agriculturists quite naturally looked to their own distinguished leaders for advice in their occupation, chemists and physiologists, who believed that a thorough knowledge of vegetable and animal chemistry and physiology must prove in the end the best guide for a correct explanation of practical results in stock-feeding, followed the course pointed out by Liebig and Boussingault. The latter advocated in 1836, as has been previously stated, the opinion, that the feeding-value of the various kinds of fodder depends on their relative percentage of nitrogen, and that the various non-nitrogenous substances present, as fat, starch, sugar, &c., serve merely as the support of animal respiration. This view, turned to account for a tabular representation of relative fodder-values, resulted quite naturally in an over-estimation of those substances which are rich in nitrogenous matter; as, for instance, the bran of various cereal grains, containing approximately from eight to fourteen per cent; the press-cakes of oil-furnishing seeds, from twelve to forty-five per cent; and the leguminous seeds, as beans, pease, &c., twenty to thirty-five per cent; whilst root-crops, potatoes, &c., containing only from one to four per cent of these substances, were, as a general rule, placed at too low a position in the table. Although his views soon suffered a serious modification, in consequence of his own course of investigation, as well as the general progressive movements elsewhere, they have, until quite a late date, exerted their influence on the making up of fodder-recipes, by favoring rather higher nitrogen rations than more recent experience advises. Probably the most important service which Boussingault has rendered to the science of rational stock-feeding in its earlier history consists in the introduction of the *chemical analysis* as an *essential requirement* for the determination of the feeding-value of an article of fodder. The influence of the chemical analysis of fodder-crops on the development

of a more rational mode of feeding stock has become from year to year more conspicuous.

Liebig, on the other hand, although in full sympathy with the final object of the investigation of Boussingault, differed from him to some extent in regard to the means to gain the same end; i.e., to establish a rational system of feeding our domesticated animals. His extensive and careful examinations into the composition of the liquid and solid constituents of the vegetable and the animal organism, and their relation to the support of life, gave him a closer insight into the mutual relation of vegetable food to animal life than any previous experimenter could claim. He taught already at an early date (1838 to 1842) that "the organic constituents of plants and animals might be properly divided into two great classes, — nitrogenous and non-nitrogenous substances. Judging from the great similarity of the representative compounds of each class of these substances, it was but reasonable to assume that the proximate constituents of the animal system are already formed in the plants.

"In the natural order, the plant precedes the animal. The constituents of the blood, and consequently of the entire body, which is formed and supported by the former, are already, in some form or other, present in the plant. The latter builds up from a single order of combination the most complex organic compounds: the animal system reduces them again to more elementary or less complicated substances.

"The nitrogenous substances serve for the formation of the blood and the tissues, and may be characterized as the plastic constituents of the food; whilst the non-nitrogenous substances (carbo-hydrates of the chemists), as starch, sugar, gum, fat, cellular matter, &c., which support the process of respiration, furnishing thereby a source of animal heat, may be named heat-making, or respiratory substances.

"The particular fitness of any plant, or any part of plants, to support animal life, stands in a direct relation to that amount of their organic and inorganic blood-constituents which are soluble in water, or are rendered soluble within the digestive organs of the animal by means of the intestinal liquid secretions.

"There is no essential difference in the support of life

between a plant-eating animal and a flesh-eater, except in the form in which they consume their food. A hungry plant-eater lives on his own fat and flesh.

"*No single constituent* of a plant can support animal life, — neither nitrogenous matter, nor fat, nor sugar, nor mineral substances: it requires a certain definite proportion of each for different classes of animals, and even for different conditions of one and the same animal."

Whilst some of these statements are not original with him, it remains Liebig's great merit to have combined the best thoughts and the best previous observations of others with his own, and thereby give to them a prominence and an influence they never before possessed. Animal physiologists of a more recent date (Voit), without questioning seriously the propriety of Liebig's chemical classification of the constituents of food into plastic and respiratory substances, prefer to arrange them with reference to their qualification of preventing a loss of albumen, fat, salines, water, oxygen, &c., in the general transformation of the animal system: they also introduce a third class of substances as important, namely, those which stimulate the activity of the nervous system. As the science of animal physiology, with its devotion to exact modes of investigation into the complicated transformation of the animal system, in spite of its rapid progress, is not yet prepared to exert a controlling influence on the solution of the practical or economical problem of the fodder question, it is but natural that Liebig's above-stated exposition of the relations of plant-food to animal life, with the exception of the source and the functions of animal fat, is still the generally accepted one in practice.

Liebig's recognition of the paramount importance of the nitrogenous, the non-nitrogenous, and the mineral constituents of plants, regarding their influence on animal life, brought him in opposition to Boussingault and his followers, who, as has been previously stated, ascribed to nitrogen alone a decisive prominence. His assumption, that non-nitrogenous substances, as starch, sugar, &c., assist in the production of fat during the process of digestion, and thereby add directly to the accumulation of fat in the animal system, furnished also a fruitful source of contro-

versy. It is beyond the scope of my present communication to describe in detail the history of the particular line of arguments on both sides: it will suffice for the present to state that the animated discussions arising from their varying views, extending over a series of years, have exerted a most salutary influence on the development of more concise ideas regarding the requirements of a rational basis for the compounding of fodder-rations. Liebig's book, "Chemistry in its Application to Agriculture and Physiology," published first in 1840, deserves here a particular notice on account of the profound interest it created among all classes of society. The new field of chemical inquiry that it pointed out attracted at once the attention of chemists in every civilized country, and induced many able scientific investigators to devote themselves exclusively to an inquiry into the principles which underlie the best agricultural practice. Boussingault's attempts to show by *actual feeding experiments* the practical value of compounding fodder-rations on the basis of an analysis of the various fodder-crops recommended itself in particular to intelligent and progressive agriculturists as a course worthy of imitation. The united efforts of these two great leaders in rational agriculture to turn chemistry to practical account in agricultural operations led soon (1850) to a more general introduction of agricultural experiment stations, — a class of institutions to which our present best farm practice is more indebted than to any other influence which can be named. Among the first contributions from that source to the science of stock-feeding are those of Messrs. Lawes and Gilbert of Rothamsted in England. Their reports on some experiments with fattening swine (1853) and sheep (1862) are of particular interest on account of the practical illustration they furnish, that non-nitrogenous substances are of great importance at certain stages of fattening stock, indorsing thus, to some extent, Liebig's view. The rapid increase of experiment stations for the purpose of studying the principles which underlie the best modes in farm practice, and of devising new propositions for agricultural enterprise, made itself soon known in a striking manner by the changes which the current notions of a proper valuation of fodder-crops suffered.

An article of fodder which formerly was considered as something of a definite individual character was shown to contain more or less *varying* proportions of starch, fat, gum, cellular matter, salines, and nitrogenous substances. It was also noticed, in the case of the same article, that when raised upon a different kind of soil, or under different modes of cultivation and fertilization, its previously mentioned principal proximate constituents differed more or less in regard to their absolute as well as to their relative quantities. Neither two kinds of plants, nor parts of plants, were found alike in their composition.

In feeding the same kind of fodder, it soon became apparent that its particular stage of growth controlled to a considerable extent its degree of digestibility, and thus its feeding-value: it was found that the same kind of plant-constituents, as nitrogenous matter, fat, &c., behaved, under similar conditions, quite differently, in that direction, in case of different plants; for instance, the nitrogenous matter in the case of oats proved to be digestible only at from 58 to 81.2 per cent; in the case of wheat-bran, from 61.6 to 93.5 per cent; and, in the case of beans, from 80 to 100 per cent; and similar relations were noticed in regard to non-nitrogenous matter, fat, and cellular substance. The particular *admixture* even, which a fodder substance may receive to make up the diet of the animal, has been noticed quite frequently to affect the rate of the digestibility of one or more of its constituents.

These and similar results, once duly appreciated, rendered it quite certain *that no one plant alone could furnish a proper standard for a general fodder valuation; nor that one definite numerical expression could correctly state the relative or absolute feeding-value of any kind of fodder.* Twenty years of exact experimental observation (from 1840 to 1860) were required to prove to the majority of intelligent agriculturists of Europe that their elaborated and popular hay-value tables were based on an erroneous supposition. The speedy general recognition of this view was largely due to the elaborated and skilfully conducted feeding experiments carried on by Henneberg and Stohman at the Agricultural Experiment Station Weende, near Göttingen, Germany. Their reports, entitled "Contribution to the Introduction of a

Rational Mode of Feeding Ruminants," beginning with 1860, have acquired a particular historical interest on account of their clear demonstration, to the thinking agriculturist, that a rational and economical mode of feeding our domesticated animals cannot be secured without a due consideration of the chemical and physiological conditions of both fodder and animal involved. The results of these experiments were not of less importance to the practical farmer, whose first interest, quite naturally, centred in the financial side of the operation; for it was shown, that, with the best modes known to determine the actual effect of fodder on the weight of the animal, the identical effect had been produced with five different kinds of fodder substances, at a difference in the daily expenses for fodder of from thirty-nine to forty-four per cent. The most expensive diet used had been 19.5 pounds of clover-hay (9.4 cents) per day for one thousand pounds of live-weight (cost of clover-hay in this case from nine dollars and a half to ten dollars per ton).

The growing evidence that a *mere knowledge* of the *chemical composition* of the *fodder* substances alone *did not suffice* to determine *their exact absolute feeding* value, and that the degree of their digestibility does exert a controlling influence on their qualification to support animal life, rendered it desirable, in the interest of a safer rule for farm-practice, to institute a detailed examination in that direction.

Dr. Grouven, chemist to the Experiment Station, Salzmünde, Germany, entered, at this stage of the progressive movement, upon a series of experiments (1860 to 1864) which have fairly revolutionized the science of stock-feeding, and have furnished, in common with such modifications as the progress in more detailed investigations has since advised, the basis of our present ruling modes of feeding farm-stock. He began with a critical compilation of the best previously conducted feeding experiments, and collected the most reliable analytical material concerning fodder substances, adding largely from his own laboratory observations. He conducted personally a series of elaborate feeding experiments, and tested not only the feeding-value of compound fodder substances, but studied also the effect of the isolated plant-constituent, as fat, starch, cane-sugar, grape-sugar, wax, and resinous substances, cellular matter, dextrine,

pectine, &c., with reference to their digestibility, as well as to their feeding effect. He determined the latter, not merely by weighing the animal on trial before and after the feeding period, which he proved (as had Voit and others before him) to be in an unusual degree deceptive in the case of short periods of feeding, but by analyzing quantitatively and qualitatively the products and the residues of the digestion, of the respiration, and of the transpiration, by improved analytical modes, frequently new and original with him. These observations were made under similar conditions, with different kinds of animals, and also with the same kind of animals in different stages of growth, under differing conditions, and when kept for different purposes. In summing up the results of his investigations, in common with those of others engaged in the same field of research (E. Wolff, Scheven, Stohman, Henneberg, Gilbert, &c.), he arrived at the following conclusions: a rational and economical system of feeding farm live-stock in accordance with the extent of our present experimental observations requires the following kind of information: —

First, How much of *nitrogenous matter*, how much of *saccharine* or *non-nitrogenous substances*, how much of *fatty matter*, and how much of *mineral substances*, in a digestible form, does each kind of animal require, not only in its various stages of growth, but also for every purpose it is designed to answer? And

Second, How much of each of these four groups of substances are present, in a digestible state, in our various articles of fodder?

The first condition rests on the physiological fact that neither one nor another of the four kinds of nutritive substances alone can support animal life: it requires all four in definitely varying proportions to accomplish specified results. A violation of this physiological law re-acts more or less seriously on the health of the animal, and leads, as a general rule, to a bad economy in the use of fodder. Sufficient experimental observation was already on hand to induce him to specify, with a considerable degree of certainty, the particular amount of each group of substances which is required for different animals in their varying stages of growth and in different conditions.

The second above-mentioned condition of success in feeding, serving as a qualification of the chemical analysis of the fodder, necessitated more actual feeding experiments to arrive at more correct conclusions regarding their relative amount of digestible substances. From forty-five to fifty fodder substances have already been studied more or less in that direction.

A natural consequence of these investigations has been, that our notions regarding the valuation of a fodder substance are somewhat modified as compared with former periods: we distinguish between the *economical value* of an article of fodder and its *physiological value.* The former finds its expression in the market-price, which, in every case, may be stated by a definite amount of money, and depends upon demand and supply in the general market. The latter depends upon the particular feeding effect the article produces. As this effect, for obvious reasons, will vary under different circumstances, depending largely on a judicious application of the article, it can be represented by but one numerical value. The best financial success in feeding operations can only be secured by taking both standards into consideration.

To illustrate the previous statements, the following experiment of Dr. Knop, a distinguished German agricultural investigator, which Grouven cites for a similar purpose, may not be without interest here. A cow weighing one thousand pounds had been fed for some time with twenty-six pounds of potatoes, two pounds and a half of oil-cakes, and fourteen pounds of hay, per day, without changing her weight; as soon as one more pound of oil-cake per day had been added, her weight increased quite rapidly; within fourteen days she had gained ninety-one pounds in weight. This result cannot be satisfactorily explained by the mere increased consumption of fourteen pounds of oil-cake; but it is reasonable to suppose that the excess of starch due to a too liberal use of potatoes was turned to a better account for the formation of animal matter, instead of passing largely into the excretions of the animal. The physiological value of the fourteen pounds of oil-cake exceeded many times their commercial value.

One of the great services which Grouven rendered to

practical farmers consists in his earnest endeavor to bring the valuable results of previous scientific research within the reach of the practical farmer.

Although personally fully convinced of the fact that much had yet to be learned in regard, not only to the intricate relations which seemed to exist between the various proximate constituents of plants, and their special functions, in case of various classes of animals, but also in regard to the influence of the individuality of different animals of the same kind, as well as of different breeds, on the feeding effect of one and the same article of fodder, &c., he felt confident that enough had already been proved, by science and practice, to furnish useful lessons for farm-practice.

He concluded, that with the recognition of the importance of the four nutritive groups for the support of animal life, and with the knowledge of the chemical composition of our fodder-crops, useful lessons for farm-practice might be drawn from a closer study of the best feeding experiments on record, by ascertaining the relative amount of the nutritive principles which the animal on trial had consumed. He ascertained in some ninety carefully conducted feeding experiments (his own included) the exact amount of the various kinds of fodder substances which the animal on trial had consumed within a given time. He calculated, subsequently, from the chemical composition of the fodder used in the trial, the absolute and relative amount of nitrogenous and of non-nitrogenous substances, fat, and mineral matter, the animal had received for different purposes in a definite period. The results obtained were tested in practice, as far as possible, to ascertain their exact value. Where practical experience did not yet furnish the exact basis for further deduction, the next best mode, to judge from analogy, was resorted to in order to aid in the work. Fully convinced that future experience would modify some of his rules for feeding different kinds of stock, he presented in 1859 the summary of his labors to the consideration of practical farmers, as a *starting*-point for a more rational and economical mode of feeding their farm live-stock. As circumstances do not permit me to enter upon a detailed discussion of Grouven's directions for fodder-mixtures, I insert here a few revised directions, of a more recent date, which

may prove not without interest in regard to the subject before us.

Live-Weight.—Kind of Animal.	Dry Substance in Pounds.	Nitrogenous Substance, in Pounds.	Non-nitrogenous Extract Matter, in Pounds.	Fat, in Pounds.	Nutritive Ratio.
Milk cow from 800 to 1,000 pounds	24–28	2.5–3	12–15	$\frac{1}{2}$–$\frac{3}{4}$	1 : 5
Milk cow, 1,100 to 1,400 pounds	28–30	3–4	15–20	$\frac{3}{4}$–1	1 : 5
Draught oxen at rest, 1,000 to 1,500 pounds,	24–28	2–2$\frac{1}{2}$	14–18	$\frac{1}{2}$–$\frac{3}{4}$	1 : 7
Draught oxen at work, 1,000 to 1,500 pounds,	28–30	2$\frac{1}{2}$–3$\frac{1}{2}$	10–14	$\frac{1}{2}$–1	1 : 4.5
Cattle for fattening, 1,000 to 1,500 pounds,	28–30	3$\frac{1}{2}$–4	14–16	1–1$\frac{1}{2}$	1 : 4
Young milk stock $\frac{1}{2}$ to 1 year old	10	1$\frac{1}{2}$	6	$\frac{1}{4}$	1 : 4
Young milk stock 1$\frac{1}{2}$ to 2 years old	20–22	2–2$\frac{1}{2}$	10–12	$\frac{1}{2}$	1 : 5
Sheep	–	1.2–1.8	10–12	0.2–0.3	1 : 7–1 : 9
Swine (varying with age), 100 pounds	4–5	0.16–0.2	1.3–2.6	0.1–0.2	1 : 4–1 : 7
Horse (working), 1,000 pounds	18.5	2.12	10.8	0.1–0.2	1 : 2.5–1 : 5
Horse, at rest	15.5	1.8	8.7	0.1–0.2	1 : 2–1 : 4.8

As my subsequent statements regarding the relative feeding-value of different kinds of corn, &c., are, in the main, in conformity with Grouven's mode of representing the analytical chemical results of the examination of a fodder for practical purposes, I consider it necessary, for a mutual understanding between the agricultural chemist and the practical farmer, to insert a short explanation of the technical expressions unavoidable in a report on scientific problems.

All our plants, and, consequently, most of our common articles of fodder, contain four groups of *nutritive compounds;* i.e., *proteine* or *nitrogenous* substances, *saccharine* or *non-nitrogenous* substances, *fatty compounds*, and *salines* or *mineral constituents.* These substances are present in absolutely and relatively different quantities in each plant or part of plant. They serve in absolutely and relatively different proportions for the support of animal life. Each kind and each condition of animals requires different proportions of

them. They are accompanied by substances of an apparently indifferent character, as far as their feeding-effect is concerned.

The entire mass which any fodder substance leaves behind after being heated at a hundred and ten degrees centigrade temperature, until it suffers no further loss of moisture, is called its *dry substance.* An increase in dry substance, in case of any plant or part of plant at the same stage of growth, indicates usually a higher feeding-value. To satisfy the craving of the animal, a certain quantity of dry matter becomes an important consideration in making up the fodder-rations for different classes of animals. In raising young stock for fattening purposes a liberal supply is also desirable, to effect a proper extension of the digestive organs, to make them good feeders hereafter.

Nitrogenous substances, or *proteine matter*, refer to three great groups of nitrogen containing compounds, of plants in particular, — albumen, fibrine, caseine, — which are essential for the formation of blood and tissues. The members of these groups differ more or less in their mode of action and their feeding-value. Those contained in animal-matter, as meat refuse, are frequently considered of a higher value than those in many plants. An important improvement has been introduced of late, in determining the amount of the nitrogenous matter by aiming at a better distinction between the more or less valuable members of a group; for instance, between true albuminoids and amides: the latter are considered almost worthless by some investigators (Keller). The earlier chemical analyses of root-crops, and young forage plants in particular, are now receiving attention in that direction.

Fatty substances include all the various natural fats of the plant: most plants contain more than was assumed at an earlier stage of inquiry. As the separation of the fat takes place by means of ether, the statements in the analyses do not exactly express the amount of fatty matter alone, but include more or less wax and resinous substances, &c., which are equally soluble in ether. The fat of the fodder seems to serve, in case of judicious fodder-rations, mainly to increase the stock of fat in the animal which consumes the fodder: its high physiological value is generally recognized by recording its amount separately in the analytical record of the analyses.

Non-nitrogenous substances include, in particular, starch, dextrine, cane-sugar, grape-sugar, gum, pectine, and the digestible portion of the cellular matter of the fodder. These substances are readily transformed, within the digestive organs, into soluble compounds of a similar chemical character, and are thus assumed to serve an identical physiological purpose.

The *nutritive ratio* of a fodder substance means the numerical relation of its nitrogenous substances (1) as compared with the sum of its non-nitrogenous, digestible organic constituents, fat included. To the fat is frequently assigned a higher numerical representation in the sum of the non-nitrogenous substances than the mere analytical results entitle it to. Grouven counts its nutritive value, in case of grains, &c., equal to three times its amount of starch; in case of straw, equal to 2.75, and, in some other substances, equal to 2.5 times. Other authorities of a later date (J. Kühn) favor the opinion that the amount of fat might be less than is usually claimed to be desirable wherever a liberal amount of sugar was present. In summing up my analytical results to *ascertain their nutritive ratio*, I have, for obvious reasons, assigned to fat merely the numerical value of the actual quantity found present.

The analytical chemical results of any of our fodder crops are, for practical purposes, usually presented under six headings: viz., —

1. Percentage of moisture lost at 110° C. temperature.
2. Percentage of nitrogenous matter.
3. Percentage of non-nitrogenous matter (exclusive of fat).
4. Percentage of fat.
5. Percentage of mineral constituents.
6. Nutritive ratio.

In my subsequent analytical statements I have calculated the results obtained, in the case of corn and cob, for one and the same state of moisture; namely, ten per cent: the analyses of other investigators are recalculated for the same amount, whenever desirable to render the difference in their composition at once apparent. The cellulose has been ascertained by actual test in I., V., X: in the remaining samples the mean of those tested has been assumed.

Analyses of Different Varieties of Corn.

Kernels and Cobs.

I.

"Wheeler's Prolific."

(The sample was sent by L. F. Mellen, Esq., from the "Franklin Harvest Club.")

The ear contained eight rows of kernels of a yellowish-brown to brown color. Its average length was from ten to eleven inches, and its average weight was from 7.5 to 8 ounces, and consisted of eighty-three per cent of kernels and seventeen per cent of cob. The average weight of one kernel was .438 grams.

The corn was raised upon a light sandy loam, which had been manured with the "Stockbridge Formula" for corn. The yield amounted to about fifty bushels per acre.

One hundred parts contain: —

	Moisture.	Fat.	Nitrogenous Matter. (Albuminoids.)	Non-nitrogenous Extract Matter.	Cellulose.	Ash.
Kernels . .	10.0000	4.7200	12.4319	69.5181	1.8900	1.4400
Cob . . .	10.0000	0.6032	3.7313	54.5226	29.8700	1.2729
Ear . . .	10.0000	4.0201	10.9528	66.9688	6.6466	1.4116

One hundred parts of the above ash contain in the case of the

	Kernel.	Cob.	Ear.
Silica, soluble in soda	1.271	17.344	3.528
Ferric oxide	0.934	Trace.	–
Calcium oxide	1.033	2.189	1.205
Magnesium oxide	14.613	5.317	14.044
Potassium oxide	25.617	60.129	30.649
Sodium oxide	2.171	5.745	2.689
Phosphoric acid	53.657	9.185	47.883

Nutritive ratio of kernels, 1 : 6.52.

II.

"Clark Corn."

(The sample was sent by H. C. Comins, Esq., of North Hadley, Mass.)

The ear contained eight rows of kernels of a yellow color. Its average length was nine inches, and its average weight was from 6.5 to 7 ounces, and consisted of eighty-six per cent of kernels and fourteen per cent of cob. The average weight of one kernel was .4 gram. The corn was raised upon a sandy loam (river-land), upon which, for six or seven years previously, grass had been raised, without manure. It was manured with the "Stockbridge Formula" for corn. The yield amounted to sixty-five bushels per acre.

One hundred parts contain: —

	Moisture.	Fat.	Nitrogenous Matter. (Albuminoids.)	Non-nitrogenous Extract Matter.	Cellulose.	Ash.
Kernels . .	10.0000	4.8600	12.4200	68.5600	2.5000	1.6600

Nutritive ratio of kernels, 1 : 6.45.

III.

"Tip-Corn."

(The sample was sent by C. E. Crehore, Esq., of Chicopee, Mass.)

The ear contained eight rows of kernels of a yellow color. Its average length was seven inches. Its average weight was from 4.5 to 5 ounces, and consisted of eighty-seven per cent of kernels and thirteen per cent of cob. The average weight of one kernel was .3 gram.

The corn was raised upon river-land which had been manured with barnyard manure (four cords per acre).

One hundred parts contain: —

	Moisture.	Fat.	Nitrogenous Matter. (Albuminoids.)	Non-nitrogenous Extract Matter.	Cellulose.	Ash.
Kernels . .	10.0000	5.1942	12.7028	68.0630	2.5000	1.5400

Nutritive ratio of kernels, 1 : 6.29.

IV.

"*Blue Texas Sweet-Corn.*"

(The sample was secured in Palmer, Mass.)

The ear contained eight rows of kernels of a blue color. Its average length was from five to six inches. Its average weight was from three to four ounces, and consisted of eighty-eight per cent of kernels and twelve per cent of cob. The average weight of one kernel was .32 gram.

One hundred parts contain: —

	Moisture.	Fat.	Nitrogenous Matter. (Albuminoids.)	Non-nitrogenous Extract Matter.	Cellulose.	Ash.
Kernels . .	10.0000	8.4869	13.5151	63.9567	2.5000	1.5413

Grape-sugar . . . . 1.83 per cent.
Cane-sugar . . . . 4.23 "

Nutritive ratio of kernels, 1: 5.79.

V.

"*Southern Corn.*"

(The sample was obtained from South Carolina, through A. A. Southwick, Amherst, Mass.)

The ear contained twelve rows of kernels of a white color. Its average length was 8.5 inches, and its average weight was about seven ounces, and consisted of eighty per cent of kernels and twenty per cent of cob. The average weight of one kernel was .29 gram.

One hundred parts contain: —

	Moisture.	Fat.	Nitrogenous Matter. (Albuminoids.)	Non-nitrogenous Extract Matter.	Cellulose.	Ash.
Kernels . .	10.0000	4.4800	12.4631	69.6669	2.0200	1.3700
Cob . . .	10.0000	0.3406	3.1413	55.7898	30.0500	0.6783
Ear . . .	10.0000	3.6521	10.5987	66.8915	7.6260	1.2317

One hundred parts of the above ash contain in the case of the

	Kernel.	Cob.	Ear.
Silica, soluble in soda	0.362	20.819	2.875
Ferric oxide	0.789	1.249	0.788
Calcium oxide	1.007	3.066	1.253
Magnesium oxide	15.497	4.561	14.046
Potassium oxide	27.988	59.818	31.676
Sodium oxide	1.890	2.293	2.718
Phosphoric acid	52.458	8.026	46.644

Nutritive ratio of kernels, 1: 6.51.

VI.

"Canada Corn."

(Sample obtained from the farm of the Massachusetts Agricultural College.)

The ear contained twelve rows of kernels of a yellow color. Its average length was 9.5 inches, and its average weight was from eight to nine ounces, and consisted of eighty-two per cent of kernels and eighteen per cent of cob. The average weight of one kernel was .3 gram.

It was raised upon a sandy loam which had been manured with barn-cellar manure (fifty-eight loads, each forty-four cubic feet, per acre). In the previous year, corn manured with barnyard manure and Bradley's XL. (in the hill) had been raised.

One hundred parts contain: —

	Moisture.	Fat.	Nitrogenous Matter. (Albuminoids.)	Non-nitrogenous Extract Matter.	Cellulose.	Ash.
Kernels	10.0000	4.7470	12.4890	68.9276	2.5000	1.3364
Cob	10.0000	–	–	–	–	0.1629

One hundred parts of the above ash contain in the case of the: —

	Kernel.	Cob.	Ear.
Silica, soluble in soda	0.306	10.314	2.233
Ferric oxide	0.977	6.687	2.078
Calcium oxide	1.797	2.372	1.909
Magnesium oxide	13.102	4.989	11.604
Potassium oxide	23.109	62.362	30.787
Sodium oxide	4.257	2.907	3.995
Phosphoric acid	55.481	10.363	47.392

Nutritive ratio of kernels, 1: 6.44.

VII.

"Canada Dutton Corn."

(The sample was obtained from John M. Smith, Esq., Sunderland, Mass.)

The ear contained twelve rows of kernels of a dark yellow color. Its average length was from 9.5 to 10 inches, and its average weight was from 7.5 to 8 ounces, and consisted of eighty-four per cent of kernels and sixteen per cent of cob. The average weight of one kernel was .3 gram. The corn was raised upon a light alluvial soil on the bank of the Connecticut River, which had been manured with barnyard manure (ten loads per acre applied in hill). The yield amounted to fifty bushels per acre. For three years previously grass had been raised upon this land.

One hundred parts contain: —

	Moisture.	Fat.	Nitrogenous Matter. (Albuminoids.)	Non-nitrogenous Extract Matter.	Cellulose.	Ash.
Kernels	10.0000	5.2514	10.8469	69.9711	2.5000	1.4306
Cob	10.0000	–	–	–	–	1.1485

One hundred parts of the above ash contain in the case of the: —

	Kernel.	Cob.	Ear.
Silica, soluble in soda	0.763	–	–
Ferric oxide	2.087	1.822	2.087
Calcium oxide	1.501	4.995	1.740
Magnesium oxide	14.564	9.586	14.347
Potassium oxide	29.481	78.846	32.883
Sodium oxide	–	–	–
Phosphoric acid	51.604	4.731	48.942

Nutritive ratio of kernels, 1: 7.56.

VIII.

"*Early Southern Corn.*"

(The sample was obtained from Messrs. J. S. Graves & Son, Hatfield, Mass.)

The ear contained sixteen rows of kernels of a light yellow color. Its average length was from ten to eleven inches; and its average weight was from fifteen to sixteen ounces, and consisted of eighty-two per cent of kernels and eighteen per cent of cob. The average weight of one kernel was .46 gram.

The corn was raised upon Connecticut-river bottom-land, upon which no manure was used, as it was in a high state of cultivation. The yield amounted to about a hundred bushels of shelled corn per acre.

Tobacco had been raised upon the land the previous year.

One hundred parts contain: —

	Moisture.	Fat.	Nitrogenous Matter. (Albuminoids.)	Non-nitrogenous Extract Matter.	Cellulose.	Ash.
Kernels	10.0000	4.9757	11.9250	68.8997	2.5000	1.6996
Cob	10.0000	–	–	–	–	1.3992

Nutritive ratio of kernels, 1: 6.76.

IX.

"*Western (White) Dent Corn.*"

(The sample was obtained from George Puffer, Esq., Mount Palatine, Ill.)

The ear contained sixteen rows of kernels of a white color. Its average length was 8.5 inches, and its average weight was about ten ounces, and consisted of eighty-four per cent of kernels and sixteen per cent of cob. The average weight of one kernel was .3 gram.

One hundred parts contain: —

	Moisture.	Fat.	Nitrogenous Matter. (Albuminoids.)	Non-nitrogenous Extract Matter.	Cellulose.	Ash.
Kernels . .	10.0000	4.2665	11.5286	70.3231	2.5000	1.3818

Nutritive ratio of kernels, 1 : 7.07.

X.

"*Western (yellow) Dent Corn.*"

(The sample was obtained from George Puffer, Esq., Mount Palatine, Ill.)

The ear contained from twenty to twenty-four rows of kernels of a yellow color. Its average length was about eight inches. Its average weight was from twelve to thirteen ounces, and consisted of eighty-six per cent of kernels and fourteen per cent of cob. The average weight of one kernel was .3 gram.

One hundred parts contain: —

	Moisture.	Fat.	Nitrogenous Matter. (Albuminoids.)	Non-nitrogenous Extract Matter.	Cellulose.	Ash.
Kernels . .	10.0000	4.5454	11.1150	69.7994	3.0404	1.4998
Cob . . .	10.0000	0.4117	3.2587	57.2537	28.2265	0.8494
Ear . . .	10.0000	3.9666	10.0151	68.0540	6.5664	1.4087

One hundred parts of the above ash contain in the case of the: —

	Kernel.	Cob.	Ear.
Silica, soluble in soda	2.612	25.478	5.161
Ferric oxide	0.331	0.621	0.366
Calcium oxide	1.611	2.293	1.696
Magnesium oxide	15.800	3.976	14.407
Potassium oxide	31.054	54.231	33.625
Sodium oxide	3.260	8.302	3.823
Phosphoric acid	45.314	5.098	40.833

Nutritive ratio of kernels, 1: 7.30.

XI.

"Crosby Sweet-Corn."

(The sample was obtained from James G. Grinnell, Esq., Greenfield, Mass.)

The ear contained fourteen rows of kernels of a white color. Its average length was from 7 to 7.5 inches, and its average weight was from four to five ounces, and consisted of seventy-nine per cent of kernels and twenty-one per cent of cob. The average weight of one kernel was .202 gram.

One hundred parts contain: —

	Moisture.	Fat.	Nitrogenous Matter. (Albuminoids.)	Non-nitrogenous Extract Matter.	Cellulose.	Ash.
Kernels	10.0000	6.9500	11.6706	68.8794	2.5000	1.770

Grape-sugar	2.14	per cent.
Cane-sugar	8.15	"

One hundred parts of the above ash contains in the case of the: —

	KERNELS.
Silica, soluble in soda	1.542
Ferric oxide	0.195
Calcium oxide	1.788
Magnesium oxide	12.542
Potassium oxide	40.237
Sodium oxide	1.187
Phosphoric acid	42.500

Nutritive ratio of kernels, 1 : 7.14.

A. — *Summary of Analyses of Corn (Kernels).*

C. A. Goessmann, 1879.

Kernels.

Number of Sample.	Moisture.	Fat.	Nitrogenous Matter. (Albuminoids.)	Non-nitrogenous Extract Matter.	Cellulose.	Ash.
I.	10.000	4.720	12.432	69.518	1.890	1.440
II.	10.000	4.860	12.420	68.560	2.500	1.660
III.	10.000	5.194	12.703	68.063	2.500	1.540
IV.	10.000	8.487	13.515	63.957	2.500	1.541
V.	10.000	4.480	12.463	69.667	2.020	1.370
VI.	10.000	4.747	12.489	68.928	2.500	1.336
VII.	10.000	5.251	10.847	69.971	2.500	1.431
VIII.	10.000	4.975	11.925	68.900	2.500	1.700
IX.	10.000	4.266	11.529	70.323	2.500	1.382
X.	10.000	4.545	11.115	69.799	3.041	1.500
XI.	10.000	6.950	11.670	68.880	2.500	1.770

B. — *Nutritive Ratio. — Summary of Analyses of Corn (Kernels) with Reference to the Digestibility of its Constituents; viz., Nitrogenous Matter, 85 per cent; Fat, 76 per cent; Non-nitrogenous Extract Matter, 94 per cent; Cellulose, 34 per cent.*

Number of Sample.	Nitrogenous Matter. (Albuminoids.)	Non-nitrogenous Extract Matter.	Fat.	Ratio of Nitrogenous to Non-nitrogenous Matter.
I.	10.57	65.35	3.59	1 : 6.52
II.	10.56	64.45	3.69	1 : 6.45
III.	10.80	63.98	3.95	1 : 6.29
IV.	11.49	60.12	6.45	1 : 5.79
V.	10.59	65.49	3.40	1 : 6.51
VI.	10.62	64.79	3.61	1 : 6.44
VII.	9.22	65.77	3.99	1 : 7.56
VIII.	10.14	64.77	3.78	1 : 6.76
IX.	9.80	66.10	3.24	1 : 7.07
X.	9.45	65.61	3.45	1 : 7.30
XI.	9.92	65.62	5.28	1 : 7.14

The above-described samples of corn rank, with reference to their feeding-value, as follows: —

IV. — Blue Mexican Sweet-Corn: Palmer, Mass.
XI. — Crosby Sweet-Corn: Greenfield, Mass.
III. — Tip-Corn: Chicopee, Mass.
VI. — Canada Dutton Corn: Massachusetts Agricultural College.

II. — Clark Corn: North Hadley, Mass.
V. — Southern White Flint Corn: Charleston, S.C.
I. — Wheeler's Prolific: West Springfield, Mass.
VIII. — Early Southern Corn: Hatfield, Mass.
IX. — Western White Dent Corn: Mount Palatine, Ill.
VII. — Canada Dutton Corn: Sunderland, Mass.
X. — Western Yellow Dent Corn: Mount Palatine, Ill.

The pecuniary valuation of the nitrogenous substances as compared with that of the non-nitrogenous substances is quite frequently stated as being equal to 5 : 1 (3.4 cents: .6 cents per pound). Fat is valued at a higher price than nitrogenous substances = 6.25 : 5. The price of every one of these three groups changes in different classes of fodder substances. It is counted highest in those substances where the highest rate of digestibility is noticed; for instance, in grains it is higher than in hay; in the latter, higher than in some kinds of straw materials. I am not prepared, at present, to give definite numerical values based upon our own market-prices, but hope to be able to do so at an early date. The above-stated relative values are based upon German market-prices.

The varieties of sweet-corns are, on account of their peculiar and superior composition, the most valuable kinds we have for feeding-purposes: they do not enter here into the discussion.

There is apparently no marked distinction between a good sample of Eastern and a good sample of Western or Southern corn. The Eastern, cultivated and harvested with better care, as a rule, than the bulk of the Western corn, seems to be the safer article.

Judging from the above results, it is but reasonable to assume that a more or less careful system of cultivation and harvesting would cause as striking variations in the chemical composition of *every one* of the above varieties, the Western varieties not excepted, as are noticeable in the above analytical statements. A good illustration of this circumstance may be seen in samples VI. and VII., both being Canada Dutton; the former contains 12.42 per cent of nitrogenous matter, the latter but 10.85 per cent, — a difference of 1.57 per cent, for which an increase of .39 per cent of fat does not compensate. The first sample was raised after a heavy dressing with barnyard manure; the latter after a light one, and ranks with some Western varieties.

The addition of the cobs to the kernels, i.e., the entire

ear ground, produces an article of fodder, which, in case of the better qualities of corn, for instance, in case of the Wheeler's Prolific (I.), has a nutritive ratio approximately equal to 1 : 7.09; in case of the Southern White Flint, equal to 1 : 7.23. This ratio is approximately equal to that of the two Western varieties (IX., X.), and also to that of sample VII., Canada Dutton of Sunderland. It means, in practice, an addition of from fifteen to eighteen per cent of corn value, in case of a good corn as compared with a light corn. Manuring pays in more than one way.

As it may not be without interest to some to obtain a more definite idea regarding the structure of the maize-kernel, and the peculiarity of one of its principal constituents, starch, I introduce some drawings of microscopic observations (Sachsse) concerning these subjects.

American Maize (Kernels).

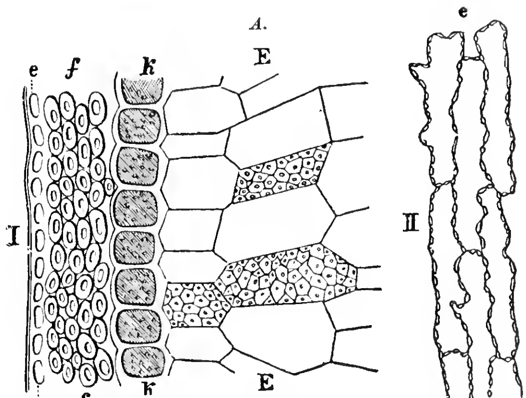
W. D. ATWATER, 1869.

CONSTITUENTS.	Early Dutton.	Common Yellow.	King Philip.	Stowell's Evergreen Sweet-Corn.
Water	10.00	10.00	10.00	10.00
Nitrogenous matter (albuminoids),	9.42	9.78	11.84	11.21
Non-nitrogenous extract matter	71.10	72.04	71.91	68.49
Fat	5.55	4.45	4.44	7.73
Cellulose	2.47	2.41	2.20	2.66
Ash	1.49	1.32	1.60	1.91

Analyses of Different Varieties of Corn.

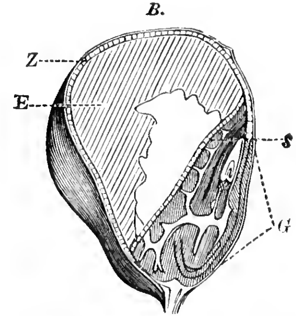
S. P. SHARPLES, 1878.

CONSTITUENTS.	Golden (8 rows), Mass.	White Flint, Mass.	Red Flint, Mass.	Mason County, Ill.	Kansas.	Burr's Sweet.
Moisture	10.00	10.00	10.00	10.00	10.00	10.00
Fat	5.08	3.41	3.48	3.77	4.66	7.81
Nitrogenous matter (albuminoids)	10.54	9.24	12.33	9.57	8.94	11.78
Non-nitrogenous extract matter	71.36	74.43	71.01	71.87	74.00	63.18
Cellulose	1.39	1.17	2.06	3 38	1.30	4.97
Ash	1.63	1.44	1.12	1.41	1.09	2.24



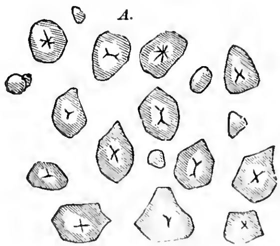
A. — Cut across the Kernel.

I. — *e e*, surface covering. *f f*, woody fibres. *k k*, layer of zein. *E E*, farinaceous albuminoid substance (endosperm). II. — *e e*, surface appearance of maize-kernels.

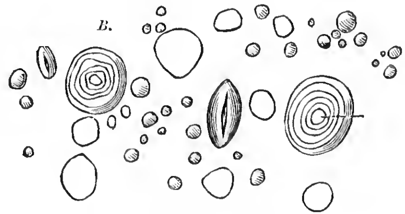


B. — Cut through the Length of the Maize-Kernel.

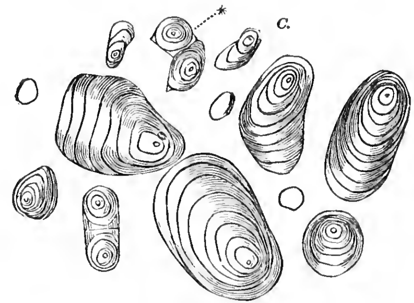
E, endosperm (albuminoid mass, rich in starch). *G*, germ (embryo). *Z*, zein (maize-gluten), layer of nitrogenous matter.



A, starch of maize (.0132 — .0220 *mm.*).



B, starch of wheat (.0352 — .1069 *mm.*).



C, starch of potatoes (.0600 — .1000 *mm.*).

C. — Starch.

Composition of Maize Kernel.

S. W. Johnson, 1879.

(Water free: deduct one-tenth to calculate for ten per cent of moisture.)

Variety.	Fat.	Nitrogenous Matter. (Albuminoids.)	Non-nitrogenous Extract Matter.	Cellulose.	Ash.
Coe's Prolific	4.41	11.21	80.36	2.42	1.60
Old-fashioned Yellow	5.23	10.99	80.63	1.55	1.60
Benton	5.60	11.18	79.94	1.52	1.76
Mammoth Sweet	8.26	13.60	72.97	3.04	2.13
Scioto	4.48	10.31	81.49	2.01	1.71
White Ohio	4.65	12.50	78.95	1.92	1.88
Wiscensin	5.42	12.85	77.72	2.28	1.73
White Prolific	4.76	12.23	81.66	1.49	1.86
Early Adams	5.40	12.14	78.83	1.66	1.97

C. — *Summary of Analyses of Corn-Cobs.*

C. A. Goessmann, 1879.

(*a*.) Cobs.

Number of Sample.	Moisture.	Fat.	Nitrogenous Matter. (Albuminoids.)	Non-nitrogenous Extract Matter.	Cellulose.	Ash.	Nutritive Ratio.
I. — Wheeler's	10	.603	3.731	54.523	29.870	1.273	1 : 14.8
II. — Southern Flint,	10	.341	3.141	55.790	30.050	0.678	1 : 17.9
X. — Yellow Western Dent	10	.412	3.259	57.254	28.226	0.849	1 : 17.7

(*b*.) Ebart, 1875. Europe.

European Corn	8.80	Not det.	3.00	54.50	30.20	2.90	1 : 18.

(*c*.) Boston Journal of Chemistry, 1878.

American Corn	7.48	Not det.	60.41		30.95	1.16	

Analysis of Cobs, representing approximately the Relative Quantities of Starch, Sugar, &c., present.

PROFESSOR HLUBECK, 1855. Southern Austria.

	I. Fine Flour.	II. Coarse Flour.
Nitrogenous matter	1.64	1.27
Starch	8.08	5.01
Fat	0.37	0.35
Sugar	3.47	2.45
Non-nitrogenous extract matter	34.49	37.85
Cellulose	39.90	41.15
Ash	2.85	3.10
Water	9.20	8.82
Nutritive ratio	1 : 28.3	1 : 36

PROFESSOR P. COLLIER, 1878. Maryland.

Nitrogenous matter	2.33
Starch	Not det.
Fat	0.72
Sugar	2.62
Non-nitrogenous extract matter	42.69
Cellulose	36.10
Ash	1.12
Water	14.42
Nutritive ratio	1 : 20

The nutritive ratio in case of the cobs is based upon the results of the chemical analysis; for no actual test regarding the digestibility of each of its proximate constituents has yet been made. The composition of the corn-cobs is similar to that of the corn-stalks; and as the corn-cobs are treated, as a general rule, with more consideration in harvesting and keeping for winter use, on account of the kernels, it is safe to say that they are, in most cases, equal, if not superior, to corn-fodder. The high rate of soluble constituents (forty-six to fifty-six per cent) places corn-cobs in competition with many of our grasses: they compare most favorably with the straw of most of our winter and summer grains. These statements apply in particular to our climatical condition, and to late varieties of corn, where the final process of growth suffers more or less from the inclemency of the season, leaving reserve material in the cobs, which otherwise would move

more thoroughly to the storehouse for the coming generation, in the kernels, its ultimate destination. A. Stöckhardt does not hesitate to place dry ground corn-cobs, pound for pound, in feeding-value, on an equal scale with fresh potatoes. As an addition to the corn-kernels, their mechanical effect, aiding in a better diffusion of a food, which, on account of its high percentage of starch, is apt to cause disturbances in the digestive organs, can only act beneficially.

Green-Maize Fodder.

1865. — PROFESSOR J. MOSER of Hungary. After sixty-seven to seventy-six days' growth: male flowers just visible.

Water	85.44
Ash, free from carb. acid, sand, &c	0.720
Nitrogenous matter (albuminoids)	2.013
Non-nitrogenous extract matter	6.982
Fat	0.820
Cellulose	4.022
Dry substance in 100 parts	14.56
Ratio of nitrogenous to non-nitrogenous matter (excluding cellulose)	1 : 3.9

1867. — PROFESSOR J. MOSER of Hungary. Two varieties, raised upon a rich soil, and tested respectively on the seventy-first and eighty-seventh day after seeding, contained: —

	I.	II.
Water	84.88	86.48
Ash, free from carb. acid, sand, &c.	0.924	0.811
Nitrogenous matter (albuminoids)	2.226	1.755
Non-nitrogenous extract matter	5.760	6.209
Fat	0.718	0.536
Cellulose	5.496	4.205
Dry substance in 100 parts	15.12	13.52
Ratio of nitrogenous to non-nitrogenous matter (excluding cellulose)	1 : 2.9	1 : 3.8

The high percentage of albuminoids is explained by the author as being due to a superior condition of the lands under cultivation.

1867. — Th. Dietrich, who tested the green-maize fodder, raised upon highly manured lands, at the beginning of blooming noticed the following composition: —

	1865.	1866.
Water	86.98	84.49
Ash, free from carb. acid, sand, &c. . . .	0.94	1.28
Nitrogenous matter (albuminoids) . . .	1.68	1.84
Non-nitrogenous extract matter	7.04	7.13
Fat	0.27	0.24
Cellulose	3.29	5.02
Dry substance in 100 parts	13.02	15.54
Ratio of nitrogenous to non-nitrogenous matter (excluding cellulose)	1 : 4.4	1 : 4

1869. — Professor Leopold Leuz, Hungary. Green-maize fodder: air dry.

Water	84.40
Ash, free from carb. acid, sand, &c.	0.924
Nitrogenous matter (albuminoids)	2.226
Non-nitrogenous extract matter	5.760
Fat	0.718
Cellulose	5.967
Dry substance in 100 parts	15.60
Ratio of nitrogenous to non-nitrogenous matter (excluding cellulose)	1 : 2.9

Composition of Green-Corn Fodder.

Professor S. W. Johnson, 1877.

	Fresh-cut. Sept. 1, 1874.		Field-cured. Nov. 11, 1874.		In Barn. Feb. 10, 1875.		Dried. Water-free.	
	1.	2.	1.	2.	1.	2.	1.	2.
Water	87.18	85.04	27.59	26.92	53.76	54.95	–	–
Ash	0.84	0.74	4.76	3.62	3.04	2.24	6.57	4.95
Nitrogenous matter (albuminoids),	0.88	0.78	4.97	3.79	3.18	2.34	6.87	5.19
Non-nitrogenous extract matter, by difference	6.44	8.06	36.37	39.42	23.22	24.29	50.23	53.95
Fat	0.28	0.22	1.55	1.07	0.99	0.66	2.14	1.46
Cellulose	4.38	5.16	24.76	25.18	15.81	15.52	34.19	34.45
Sum of dry substance in 100 parts .	12.82	14.96	72.41	73.08	46.24	45.05	100	100
Ratio of nitrogenous to non-nitrogenous matter (excluding cellulose),	1 : 7.6	1 : 10.6	1 : 7.6	1 : 10.6	1 : 7.6	1 : 10.6	1 : 7.6	1 : 10.6

Actual feeding experiments, as reported by J. Kühn in his late publication, tend to prove, that, in the green-maize fodder, there are in a digestible form, of the amount stated by analysis, seventy-three per cent of the nitrogenous matter, seventy-five per cent of the fat, sixty-seven per cent of the non-nitrogenous extract matter, and seventy-two per cent of the cellulose (cellular matter). These relative proportions vary somewhat with the age of the plant, growing lower with the advance of growth. Taking the difference noticed in case of a good meadow-grass and a good hay obtained from it, as a standard of comparison, the above-stated rate of digestibility would be respectively from sixteen to twenty per cent less in the dried state of the fodder.

The *nutritive ratio* of common green-maize fodder, in case of from sixteen to eighteen per cent of dry matter, is reported equal to from 1 : 9 to 1 : 10. The green fodder from the sweet-corn varieties is quite properly considered of higher feeding-value, pound for pound, on account of the large percentage of sugar (six to twelve per cent) it contains: the latter amounts, at certain stages of the growth, in some instances, to one-half of the dry matter. The recent observations in young succulent crops, and root-crops in particular, regarding the presence of considerable quantities of nitrogenous substances (amides) of less feeding-value than the true albuminoids, in the grains, &c., recommend, for the present, calculations on a somewhat lower percentage of nitrogenous matter than has hitherto been accepted.

Examinations of Several Varieties of Corn regarding the Amount of Sugar contained in the Juice of the Stalks.

I.

Common Corn-Fodder.

(Massachusetts Agricultural College Farm.)

Vigorous plants, with the tassels just appearing; the canes cut six inches above the ground. Lost 84.82 per cent of moisture at 212° – 220° F. temperature, and left 15.18 per cent of dry vegetable matter. The juice of the fresh-cut canes showed, —

Specific gravity	5.91° Brix's saccharometer, at 80° F. temperature
Grape-sugar	4.35 per cent
Cane-sugar	0.28 per cent

II.

Common Sweet-Corn.

The corn was already somewhat hard when the stalks which furnished the juice for my examination were cut: the canes were a few days old when pressed.

Specific gravity of the juice . . .	8.7° Brix's saccharometer at 78° F. temperature
Grape-sugar in the juice . . .	6.6 per cent
Cane-sugar in the juice . . .	None

III.

Blue Mexican Sweet-Corn.

The ears were just fit for the table when the juice of the cane was obtained.

The canes lost at 220° F. temperature 82.56 per cent of moisture, and left 17.44 of dry vegetable matter. The juice of the fresh canes showed, —

Specific gravity	12° Brix's saccharometer, at 78° F. temperature
Grape-sugar in the juice	2.06 per cent
Cane-sugar in the juice	7.02 per cent

IV.

Stowell's Evergreen Sweet-Corn.

The ears were in the same advanced state of ripening as the previously-described sample, i.e., just fit for the table.

Fresh canes lost moisture at 220° F. temperature	79.62 per cent
Fresh canes left dry organic matter at 220° F. temperature	20.38 per cent
The juice weighed	12.7° Brix's saccharometer, at 78° F. temperature
The juice contained grape-sugar . .	4.85 per cent
The juice contained cane-sugar . .	5.70 per cent

From the above statements it appears, that, in samples I. and II., the sugar amounts in weight to about one-third of the entire dry organic matter of the canes; whilst in samples III. and IV. it amounts to about one-half of the dry vegetable substance present. The stage of growth controls these relations.

Sour-Corn Fodder.

(Green-Corn Fodder from Silos.)

A new mode of applying green-corn fodder has been of late more prominently discussed in agricultural papers which aims at preserving the fodder for a later period in the season in its unimpaired condition. The fresh-cut corn is either by itself packed tightly into pits, or previously cut, and mixed with two parts of fodder to one part of straw, and stamped into cemented cisterns, to be kept there, under exclusion of air, to undergo a kind of fermentation.

	I.	II.	III.	IV.
Water	82.20	81.28	59.02	60.72
Nitrogenous matter . . .	0.90	1.24	2.44	3.74
Fat	0.18	0.26	0.66	1.50
Sugar	0.13	0.15	0.38	1.89
Non-nitrogenous extract matter .	7.67	9.58	18.45	14.59
Acid (acetic acid or lactic acid) .	–	0.22	–	0.40
Ash	0.95	2.25	3.89	8.43
Cellulose	3.76	4.91	15.15	8.70

No. I. of the above analyses refers to a sample of corn before blooming; No. II., to the sample (I.) after fermentation; No. III. represents a sample of corn in blossom; and No. IV., the same sample mixed with straw, as previously stated, and subsequently fermented. The pits, or cemented cisterns, are usually from twelve to eighteen feet long, four to six feet deep, and about three to four feet wide: the layer of earth which covers the mass has to be several feet thick to exclude as effectually as possible the free access of the air. Four weeks usually suffice to complete the fermentation. Forty to fifty pounds of the fermented stalks are usually fed with from two to three pounds of oil-cakes to milk cows, with good effect. Sixty to seventy pounds of fermented-corn fodder are equal to from one hundred to one hundred and twenty pounds of fresh green-corn fodder.

The fermented-corn fodder has of late been largely used by farmers in France in particular, who sell their sugar-beet roots to distant sugar-factories, and who cannot afford to carry the beet-pulp back, on account of the too high rates of transportation.

Mr. FLINT. According to the programme, the Committee had arranged for a discussion to follow Professor Goessmann's most admirable paper; but you will all remember that one paper, giving the practical experience and daily life of a first-class farmer in Essex County was omitted on Tuesday, and the Committee are very desirous that the farmers here should have an opportunity to hear Mr. Webster's paper on his farm-experience. The Committee, therefore, have arranged to have that paper presented at this time; and, if there are any questions to be asked in connection with Professor Goessmann's paper, they can come up after the reading of Mr. Webster's paper.

The CHAIRMAN. I have now the pleasure of introducing to you Mr. RICHARD WEBSTER of Haverhill.

MY FARMING EXPERIENCE.

BY RICHARD WEBSTER.

My farm-life began at seven years of age, and under the usual forbidding experiences of home-sickness, hard work, and unsatisfied yearning for the pleasures and careless joys of boyhood. I continued on a farm until my thirteenth year, then went to the city, and worked until I was seventeen years old, and then began to learn the trade of carpenter, which I followed as apprentice, journeyman, and contractor, with very little interruption, till the fall of 1860, when I gave up entirely. My first thought of farming was in the spring of 1859, after continual failing health for two years previous, when my physician told me a change of occupation was my only hope for life. With weakened arm, struggling with the problem "how to live and pay for it," you see I have nothing but the every-day kind of farming to talk about.

In the spring of 1859 I purchased the Haynes Place, of forty acres, situated in the West Parish of Haverhill. The land slopes from its frontage, of thirty-two rods, to the borders of the Merrimack River, whose waters enclose a small island overgrown with wood, which, in times of freshet, is also overflowed. Besides this reduction from available land, there are two acres in grove and woodland that are of no profit, except the growth of wood, leaving the improvable soil about thirty-seven acres.

The farm, with its dilapidated buildings, cost nineteen hundred and fifty dollars. The place had been so neglected for twenty-five years, that its appearance was not only forbidding, but seemed a reason for letting it alone.

The first year of my ownership was so full of dread and dislike of the undertaking, that I continued my trade, and let the place to a Frenchman at the halves. It was a good bargain for him, as he made sure of his half, and divided the other half with me. He was farming at three-fourths, and I at one-fourth.

The succeeding year, 1860, I took command in the field; though I continued my trade in the city, and consequently was obliged to hire all the real work done on the place by common farm-hands, who, of course, worked for their pay, rather than for my success.

My early life had taught me nothing of any value in farm-work; and, since the date of the purchase, it had been my theme of conversation and study to decide how to begin and go ahead with the scraggy place I had bought.

I had been told by my acquaintances that farming did not pay. I opened a series of accounts with different crops, to which I shall refer.

A dozen or more acres of land were so surrounded by knolls, that water stood nearly all the year a foot deep about the thick growth of alders, and made this tract useless. I saw at once the advantage of redeeming it, because of its convenience, its high and sunny location, and the generally favorable conditions that could be secured for it at small cost.

To drain off the water was my first move; and it had to be done with pick and shovel, a distance of fifty rods, and at a depth of three feet. This open drain was made the first season, and then the piece was used for pasture for several years. The larger trees were cleared from the place by the process of cutting off the roots some two feet from the trunks, and hitching the chain high in the tree to obtain a leverage. After being pulled over, the plan was to clear the dirt from the roots, saw off the stumps, and haul into piles to be burned; the trees being cut into firewood. To remove the alders, I devised a sort of grappling-iron, made of one and one-fourth inch round iron, shaped so that the greater

the force required to pull the tree out of its place, the more firmly the grip of the iron upon the roots. Over the whole farm, along the walls, and in heaps in the fields, cart-loads of stones had been dumped. I took off nearly a hundred cords of them. Among them was a rank growth of trees, with alders and brush, that at first seemed to mock all attempts to remove them.

The loose stones had first to be gathered, and many others, such as cropped above the surface, and could be dug out, besides hundreds that had to be blasted in order to remove them. The surface of the farm was so uneven, that numerous mounds had to be reduced, and low places filled up.

I had found that rocky land was generally strong, fertile, durable, crop-bearing soil; and though it has to be conquered before it will yield, so does any thing else that is worth having. Were I to select a new farm to-day, a rocky one would be my choice; not that there is a great gain in the sale of the stone, because it cannot always be sold, but for the reasons I have mentioned. Land with round, white stones, should be avoided.

It may be interesting to know how much business I have done in stone harvesting. The time and labor devoted to it was all taken out of the legitimate farm-work, hence must be called the cost of the stone-crop. You will see that it has cost a large per cent of its income.

I have sold 1,560 cords of stones of all sizes, and for all building and road purposes, besides some three hundred and fifty cords that have been used in under-drains, walls, and buildings on the farm. I have received an average of a little over five dollars per cord, or an aggregate of about eight thousand dollars. It has cost me to dig around, blast, and take out with bars, stones in the field, a thousand days, or twelve hundred and fifty dollars; to haul out and pile up, with team, seven hundred days, or three thousand dollars; to deliver the stone sold from the farm, it has cost me, in labor of men and teams, five thousand dollars.

The work of getting out stone is fraught with many aggravating, perplexing, costly, and even dangerous circumstances. The breakage of chains, wearing out of drags (of which I have used fifteen), wear and tear upon wagons, all implements and draught animals used, cost of powder, fuse, and

drills, are items of expense, and considerations that cannot be overlooked. I have used up two wagons, each costing a hundred and fifty dollars, beside endless repairs. Two valuable horses were worn out in the service. Bad debts have also increased the amount of shrinkage from the gross receipts.

So much for the outgo and income of the stone-crop.

The removing of trees, shrubs, and bushes, has cost three times their value for fire-wood.

I resolved that all profits for the first ten years should go back into the farm in some shape. It was my estimate of what would be necessary to bring the place up to a good condition for profitable work. When I took the farm, it produced, the first year, five tons of hay, besides a fair yield of common crops, and that was about the possible capacity of the farm in its run-out condition.

In 1860 I built a five hundred and fifty dollar cottage to take the place of the house that had stood a hundred and thirty years, and also found it necessary to expend two hundred dollars on the barn, and built a corn-barn and piggery, at a cost of a hundred and fifty dollars.

In 1861 all of the walls dividing my land from neighboring farms required rebuilding, at an expense of a hundred dollars. These outlays included my principal extra costs, besides the yearly running expenses, until 1863, when I commenced in August a process of under-draining, which I have continued to the present time, the work being now complete. My first under-drain ran from east to west, and emptied into the open ditch that I had dug in the twelve-acre piece the first year. My subsequent subsoil drains are lateral feeders to the same outlet, and are made partly of drain-tile. There are between five and six hundred rods of under-draining on the farm, and the cost has been not far from three dollars per rod for the main, and two for laterals.

The subject of drainage is an important one. The surface-wash from adjoining land upon one's farm may carry off valuable loam, expose tender roots of young trees, or, in many ways, destroy the piece; while it is also true that tracts which seem to require no under-drainage are greatly improved by it. The "true inwardness," so to speak, of one's farm, must be thoroughly understood before a correct system of drainage can be instituted. Drains on a level should be about three

feet or more below the surface, the top be low enough, so that the land may be ploughed, and not disturb the drain.

The square stone drains, as you probably know, are the cheapest where there is stone with which to build them. The tile-drain should be sunk the same depth; and flat stones, reaching from the top of the pipe, and spreading to the sides, should be snugly laid together; for, by so doing, three spaces (two besides the interior of the tile) are open all the time for the conveyance of the water. This structure of flat stones and drain-tile I cover with about a foot of small stones for a filter, and cover these with a layer of an inch of leather-chips, felt-trimming from hat-factories, which are the best, or sods, if neither of these can be obtained.

Drains should be built from the top down hill (this is very important), to prevent their filling up while being laid. The only trouble I have had with drains is from meadow-moles working through from the surface, and letting in the surface-wash. I consider drainage one of the most important im provements on the farm, and should hire the money to do it, rather than undertake to cultivate wet land without.

In 1865 a new barn was needed to accommodate the great increase of crops; for, though it had been outgo above income the first three years, in 1863 the place more than paid its running expenses, and has ever since. This new barn, which is forty by sixty feet, I built from plans that were the result of my personal experience in farm-work. Five plans were duly developed before I was fully satisfied that I had the right one.

It is apparent, that to cover many conveniences and much room with a single roof is the cheapest, and, in general, the best way.

My barn has three entrances for teams, the first into the basement, which is for the purpose of hauling out manures, for drawing in and storing the root-crop, and for storage of large carts and wagons.

You will see at once that there are three sections, — for manures, roots, and teams.

No part of the barn is more important, and none has more to do with the general prosperity of the farm, than the cellar. It should be tight, to prevent the absorption or waste of the liquid from the manures. It should be light, to admit the

sun's warmth, and for convenience. It should be most carefully ventilated, to prevent taint of smell and taste upon the crops stored above, also to insure pure, healthy air for the stock, and also to keep the timbers of the building dry, and free from decay. The section for the storage of roots is separated from the main cellar by a four-inch brick partition. Large doors connect this section with the driveway into the cellar, and the partition is pierced near its top for ventilating purposes. The root section is also subdivided by a brick partition, to secure a room about one-fourth of the space for sorting and pickling cucumbers, cutting and preparing roots for feed to the stock, and to pack vegetables for delivery in the markets.

The first floor of my barn is divided into three departments. On the easterly side I have stalls for my horses, and tie-up for my cattle, a pen in which to turn animals loose, also a stairway to the next story. The central part is used for wagons, or, in summer, to put the mowing-machines, horse-rakes, tedder, &c. On the westerly side my workshop is situated; next to the workshop is the grain-room, and, farther on, my tool-room, eleven by fourteen feet, in which all my farm-tools, after being cleaned, are put away. I consider the care of tools of great importance. My utensils (except some of my haying tools) are hung on iron hooks around the room. On one side I have a two-by-seven plank spiked to the studding; on this plank I have sliding hooks similar to those used by butchers for hanging meat. Upon these hooks I put my ploughs, cultivators, &c., which should be hung alternately, — first beam up, next handle up, and so on. By this system sixteen ploughs can easily be hung upon the joist, and the floor of the room left clear.

Before putting away for winter, I clean them all, and apply a coat of lard and rosin boiled together, which prevents the implements from rusting.

I make it a rule for all of my workmen to bring from the field, clean, and put away, the tools they have been using through the day, thereby saving time in looking after misplaced tools, and also preventing rust. This rule, I am sorry to say, is too often neglected. On the second floor of my barn are bays for hay, &c.

Let me state here how I cure my hay, and how I believe

others may cure theirs, avoiding the disastrous consequences that have so commonly been the experience of farmers. Hay means first grass, and, even before that, it means preparation of the soil, and the correct method and time of sowing the seed.

The ground that has been used for garden-crops, and the like, is especially adapted to grass; and all land that I intend for this crop has a heavy manuring in the spring. The crop is taken off as early as possible, when it is ploughed deep, harrowed, and then left to the action of the elements till the last of the autumn or early winter.

I have sown grass-seed in this way as late as the middle of December. If you are sure of clearing your land for grass by the last of August, the seed may be put in then. It is well to act upon the principle that the grass should get a good start, so as to escape being winter-killed, or else not be sown till the seed cannot take root before the early spring. I have never used any top-dressing except salt, which, sprinkled on in the spring, generates moisture.

The time I mow herd's-grass is when it is in the full of its second blossoming, which with me is usually the last week in June, or first of July. Clover should be cut when the blossoms are beginning to die. Red-top is mowed about the same time as herd's-grass. It is my purpose to have the hay-crop in the barn by the 12th of July.

Mowing in a dull day has the advantage of a prospect of fair weather the next day. So, also, has the practice, which I generally follow, of mowing late in the afternoon, the surety of catching the earliest rays of the next morning's sun. The tedder can be put at work early; and, by going over it twice, the hay can be gathered the same day, unless the yield is remarkably heavy. Many farmers let their hay dry until so brittle that the goodness is gone from it, and the action of too much sun has proved a damage.

I find it important, as the time is short, when haying, to have plenty of help. In the morning they may be at work hoeing, opening hay, and other work.

In getting in hay, I make two gangs, — one of three, in the field, to put the hay together, load, and rake after; another gang of three, in the barn, to stow away, back out the cart, clean up the floor, and get ready for the next load. By this plan much time is saved, and a uniformity of work secured.

It is a common theory, that hay which is moist can be preserved from injury by sprinkling a little salt upon it when being stored. I fail to find sufficient reason for indorsing the practice; but I do recommend the use of a small quantity of dry-slacked lime, say about two quarts to a ton of hay. The lime absorbs the moisture, and preserves the bright green color of the hay which it has when it comes from the field. Hay should be "trodden down" well when being put away: this forces the gases and dampness to the top, and prevents it from becoming musty. Rake down the sides of each bay as soon as filled; for, by so doing, the different lots will not bind upon each other. My barn is ventilated from the cupola.

Over the driveway into the barn I have built a slat flooring, upon which damp hay, or a load that has been gathered to escape a shower, is spread, and the air allowed to circulate underneath and upward through it, thereby curing it in the barn. This flooring is used later in the season for storage of corn-fodder, which is too often heated and moulded by being heaped in the barn. During the past season I have added to my barn an extension of twenty-two by forty feet, for the accommodation of the increase of my hay-crop. It will at once be surmised that this is a favorite crop with me, and so it is. My farm now yields sixty tons from twenty-three acres, while the product of the land devoted to hay when I took the place was only about five tons from eight acres. Now all but three acres of my farm is under cultivation of some sort, and the three acres that I now devote to pasturing are taken from my mowing-field.

My method has been as follows: after I had taken the trees and bushes off, I have ploughed as well as possible with four yoke of oxen, taking as large and strong a plough as I could get, and for that business there are none too strong. On one piece of six acres it cost me nearly forty dollars for repairs on ploughs and chains.

While ploughing, I have two men to follow the plough, turn sods, and take out stones. I then harrow, take off what roots, stones, and the like I can, and then plough crosswise with two yoke of oxen, a man following the plough to take out stone. Next go over the ground with a wheelharrow; and, if time permits, I plough again with a pair of horses, or one yoke of oxen, after which, clear away more of the

stones and roots. The land is now ready for manuring, and putting in the seed. After harvesting the piece in the fall, plough again, and once or twice the following spring, when, if the land is not too full of roots and stone, I consider it pretty well conquered.

Whenever I find a piece of land "bound out," or yielding but poorly in grass, I cut the crop early, then plough the land, put on the wheelharrow, going over it lengthwise and crosswise. For turnips, I put on a top-dressing of compost of manures, and harrow and brush the piece ready for sowing: if only for cabbages and cucumbers, I furrow and dress in the hill. This process gets the land clear of grass-roots, and well rotted for the next spring's cultivation. After gathering these crops, plough late in the fall, and there will be little to fear from witch-grass.

I dig around and blast large stone usually after I have got my fall work done, and sometimes have worked late into the winter, moving them from the ground when it was frozen. A little snow then will render the moving of stone much easier, as a pair of horses will pull more on snow than three will on bare ground.

These stones I have put in large piles on some knoll, when convenient, until hauled off for sale. Being left on a side-hill or knoll, they can be loaded easier than on level ground. In loading stone I use a skid made from white-oak or locust plank three by six inches, with two cross-pieces bolted on the under-side, leaving the planks about fifteen inches apart for the chains to pass. In summer we use water to wet the ski l, as this will facilitate the sliding of the stones. I place the skid against the side of the wagon, and with a pair of horses, using a long cable chain made for the purpose, haul the rocks into the wagon, which should be simply a strong platform.

I plough deep, and like to have all land ploughed two or three times before planting, as I think that horses can pulverize the land much better than men; and, if the soil is well ploughed and harrowed, it is very little work to do the hoeing. I usually sow to grass after the third season of cultivation. The land being ploughed and harrowed, the next step is to apply the manure, and plant. The first year, especially for corn, beans, squashes, cucumbers, tomatoes, and

many other kinds of vegetables, I manure in the hill. The second year, I put in a root-crop, and spread the manure on broadcast, putting it under with a wheelharrow, or plough very shallow, just enough to cover the manure. I think that the nearer the surface you can have the manure, and have it well covered, the better for all crops, not excepting the grass-crop. The power of a light covering of earth to prevent the escape of ammonia is wonderful.

Now, having got the land into grass, I will give you one or two experiments showing the cost, and also the product of the different pieces.

In the summer of 1868 I entered one piece of two acres and seven-eighths for premium. The committee visited me in the fall. I give you their account and comments. I would say, that, on this piece, I did not have so many large stones to blast, or trees to dig out, as on many tracts I have subdued; nor did I plough it as much as I have land since.

Mr. William R. Putnam says, "Three of the committee visited this piece of land in September, and were pleased with the improvements made upon it. It will be seen by the statement of Mr. Webster, that he was liberal in his expense, having spent over twelve hundred dollars for labor, seed, and manure, on less than three acres in three years. But, large as the expenditure was, the income was still larger. We have looked at the amount of sales from this piece for the three years with some care. It will be seen that the prices were the highest retail ones, so that he must have carried the crop to the consumer. He was fortunate in having a large part of it planted with potatoes in 1864, which he sold for four hundred and thirty dollars. Again, in 1865, he was fortunate in having so many squashes, when they sold high.

In 1866 his crops appear to have been much larger, but his sales were not as large. He has not given us any estimate of the expense of marketing the crops. In the balance which he has struck, it appears that he has made $953.15 by his operation. The committee think that twenty per cent should be deducted for marketing; and, if we leave out of the account the three hundred and fifty dollars, the estimated improvements of the land, we shall have about three hundred and fifty dollars gain. The committee awarded to him the first premium of fifteen dollars."

STATEMENT.

Dr.

1863.		
Ploughing in the fall	$26 25	
Turning sods	10 00	
		$36 25
1864.		
Harrowing, taking out roots, &c.	$15 00	
Furrowing, dunging out, and planting	35 00	
Thirty bushels seed-potatoes	30 00	
Six quarts corn	60	
Fifteen cords manure	110 00	
Hoeing, &c.	40 00	
Harvesting	38 00	
Interest and taxes	15 00	
Ploughing in fall	15 00	
Digging out bushes, draining, &c.	100 00	
		398 60
1865.		
Ploughing and harrowing in spring	$18 00	
Furrowing, dunging out, and planting	35 00	
Twenty cords manure	160 00	
Hoeing and weeding	42 00	
Potatoes, corn, and other seed	20 00	
Interest and taxes	17 00	
Ploughing and draining in fall	75 00	
Harvesting	35 00	
		402 00
1866.		
Ploughing and harrowing	$18 00	
Seventeen cords manure	170 00	
Furrowing, dunging out, planting	40 00	
Seed-corn, and other seeds	18 00	
Hoeing, transplanting, &c	45 00	
Interest and taxes	18 00	
Harvesting	30 00	
Ploughing, grass-seed, &c.	28 00	
Labor getting out stone	25 00	
Seventy pear and sixty apple trees	90 00	
		482 00
1867.		
Cutting and getting in hay	$10 00	
Interest and taxes	20 00	
Picking stones, manure, &c.	40 00	
Two acres and seven-eighths of land	120 00	
		190 00
Amount		$1,508 85

Cr.

1864.		
By fifty bushels potatoes, at $3 per bushel	$150 00	
Three hundred and fifty bushels late potatoes, at 80 cents per bushel	280 00	
Twenty bushels corn, at $1 per bushel	20 00	
Early corn	15 00	
Fodder and turnips	20 00	
		$485 00
1865.		
By pease sold	$45 00	
Tomatoes	90 00	
Six tons and a quarter of squashes, at $60 per ton	370 00	
One hundred and seventy bushels corn in ear	150 00	
Two tons and a half fodder	20 00	
One hundred and twenty-five bushels potatoes	105 00	
One-third acre fodder-corn	15 00	
		795 00
1866.		
One hundred and eighty bushels potatoes, at 60 cents per bushel	$108 00	
Eight tons and a half squashes	255 00	
Sweet-corn sold	105 00	
Cabbages	160 00	
Pease and beans	22 00	
Turnips	12 00	
		662 00
1867.		
Three tons and a half hay (estimate)	$70 00	
Carrots, beets, tomatoes, &c.	75 00	
		145 00
Stone sold	$25 00	
Two acres and seven-eighths land	350 00	
		375 00
Amount Cr.		$2,462 00
Amount Dr.		1,508 85
		$953 15

In the report of the committee, the statement that I must have sold directly to the consumer was only partially true, most of the crop being sold at the stores; but I was fortunate in the prices being high those years. They also deduct three hundred and fifty dollars, the estimated improvement of the land, but do not credit me with the first valuation of

a hundred and twenty dollars. The cost of marketing is not very high; but I have not credited any thing used in my own family, which would make quite a difference. Also all of the manure was charged to the crop; while a portion should have been credited to the land, for the hay, of which I took off a crop consecutively for seven years before I ploughed it again. Also the whole expense of under-draining, and ninety dollars for pear and apple trees, are charged to the piece, which does not seem just, as the benefits to be derived from these improvements are sure to continue for many years. Hence I think it proper to credit to the piece, as the real improvement upon it from its condition at first, as follows: at least one-third of the manure, or a hundred and fifty dollars; next the trees, or ninety dollars; the drains, or a hundred and fifty dollars, — added to the first estimated worth of the land, a hundred and twenty dollars, gives an aggregate value of five hundred and ten dollars, which can only be considered a low appraisal of its present value, as it is practically worth two hundred dollars per acre, or a total of six hundred for the piece, showing a gain of four hundred and eighty dollars. I will mention one other experiment of 1879, when crops sold low enough to please any one.

I mowed four acres of land June 19, 1879, and put into the barn, the 20th, about three tons of hay, and then ploughed on the 22d, 23d, 24th, and 25th, and harrowed an acre and a quarter on the 25th.

On a piece of ninety rods I put four cords of manure in the hill, and planted to cucumbers.

On the balance of the acre and a quarter I put three hundred pounds Stockbridge's Phosphate, and sowed to ruta-bagas, sixteen inches apart. On one acre I put twenty-two dollars' worth of Stockbridge's Fertilizer, and planted to sweet and pop corn, which were both nearly killed by frost. The balance of the land I harrowed, and the last of July set to cabbages, using three hundred pounds of Coe's Phosphate, six barrels wood-ashes, five bags refuse salt, and two cords stable-manure. The manure with the phosphate was put into the hill; the salt was harrowed in; and the ashes put around the plants.

STATEMENT.

Dr.

Cost of haying	$8 00	
Ploughing	20 00	
Harrowing, setting out cabbages, &c.	28 00	
Cultivating and hoeing	17 00	
Six hundred pounds phosphate	13 50	
Stockbridge fertilizer	22 00	
Manure and ashes	44 00	
Interest	48 00	
Harvesting	75 00	
		$275 50

Cr.

Three tons hay	$48 00	
Sweet-corn sold	41 00	
Cucumbers	210 00	
Three hundred bushels rutabagas (estimate)	50 00	
Cabbages	105 00	
Have on hand cabbages	40 00	
Fodder	6 00	
		500 00
Profit		224 50

I could relate many experiments on different pieces, but will let these two suffice. I have one piece of five acres, on the lower part, or river-front, of the farm, which I was told by my neighbors, when I bought the farm, would bear nothing but rye.

The piece had been sown to rye, I was told, for over a hundred years. Having been owned by one family, as grandfather, father, and sons, for a much longer period, they would trace back the proof of the statement. I sowed it to rye two years; the largest yield being forty-eight bushels. I thought that would not pay: so the next spring I decided to try an experiment on this piece, and planted it to every kind of seed from which I was intending to raise a crop. Manure was used in the drill and hill. The result of my trial showed me that it was most excellent land for corn, beans, turnips, pease, carrots, &c., very good for tomatoes, squashes, cabbages, potatoes, and sugar-beets, not very good for onions, cucumbers, beets, and some other root-crops.

After planting three years, I sowed a portion to grass. It

did very well for two years, but did not hold out as well as I wanted; and so I have kept it under a state of cultivation almost ever since. With regard to manure, I have used almost every kind I ever heard of and could buy. Among them were a great many humbugs. At first I did not buy much manure, as I did not have the money to pay for it, and did not think it would pay to buy, if I had possessed the means. After 1862 I began to buy from the stable in town, in a small way, and used some poudrette and phosphate. Since then, have used Peruvian, Pacific, and other guanos, fish-offal, and pomace; have bought at different times all the slaughter-house manure I could; I have also used some different kinds of phosphate, and all I could buy of wood-ashes, Stockbridge Fertilizer, wool-waste, hen-manure (of which latter I have bought a hundred and fifty barrels in a season); last and best, I have purchased largely from the stable, if I could, where hogs were kept on the manure, and I have yet to plant the crop that I cannot grow successfully with that fertilizer. I would not condemn phosphates, nor other patent fertilizers, by any means, especially if I were located quite a distance from a city, and could not obtain manures such as I can as now situated. But I should make all the manure I could first on the farm. This can be done in many ways; and one of the most important is a barn-cellar, in which all of the liquid can be saved. I have the bottom of my manure-pen eight inches lower than the other portions of the barn-cellar; and, as it is thoroughly cemented, it saves all liquids which are conducted into it. The liquid from the stock is nearly equal to the solid manure. I gather leaves for bedding, tie stock up nights all the year round, and in many other ways have contrived to utilize all sources for manures.

I have ploughed in clover and buckwheat with good results, as fertilizers, and think this latter method, for some lands, is a very cheap way to manure. All dead animals make a most excellent fertilizer, a horse or cow being equal to a cord of the best manure. I put them in an out-of-the-way place, dig through the soil, cut the animals open, and put in one cask of unslacked lime. The largest crop of melons I ever raised was on manure of this kind. Hen-manure I keep until it is a year old, working over occa-

sionally with plaster. I have made a fertilizer from bone at different times, using oil of vitriol to decompose it. A good and cheap fertilizer is made from two barrels of ground bone, four barrels of hardwood ashes, one bushel of salt, and seven pails of water, put into hogsheads in layers; bone first, then ashes and salt, lastly the water. On heavy or clay soil, sand or gravel ploughed in is most excellent. I have used salt for the last fifteen years; put it on all of my manure-heaps before being worked over, spreading it on, and harrowing it in, for onions, asparagus, cabbages, and potato-crop. It is the only top-dressing I have ever used on grassland. I have bought a car-load in a year; but some years I do not use more than fifty bushels: this is refuse salt. I do not haul any loam under my barn to mix with the manure, but draw from the stables in town dry manure, of which I usually get a plenty.

I use horse-manure on my dryer land, as it contains moisture longer than any other kind. With me, it does not pay to keep hogs, except enough to work over my manure, and eat up the refuse from the house.

Coal-ashes are worth hauling, I think, if not too far off. Where I have used them in the hill for squashes, I have been troubled very little with the borers. I have spaded them in quite thick around my fruit-trees. I do not know whether they keep off the canker-worms or not; but I have not been troubled with them, although they have been on my neighbors' farms, adjoining mine, for ten years. I have used salt hay, with no other fertilizer in the hill, for potatoes, and get a good crop.

For crops I plant a variety, then I am sure of having some one or more that will pay; and, if any one crop has been a glut in the market this year, I should plant freely of that kind next year. I raise altogether field-crops, as I am away from the farm so much, that I cannot attend to hot-beds, although I could have done much better, could I have attended to it, to have raised much under glass. I buy my seed from the most reliable firm I can find, as it does not pay to plant poor seed. Have bought for the last ten years of Schlegel, Everett, & Co., and have hardly ever got any poor seed from them. Some kinds I save myself, keeping the best. I have planted potatoes in nearly all ways, but

now grow in drills. I do not cut the potato as much as I used to. I can plant small potatoes for two or three years very well, by cutting off the seed-end, and throwing away. Medium-sized ripe potatoes I consider the best to plant.

The middle part of an ear of corn will ripen earlier than the tip. It will not sprout much below sixty degrees. All seed should be covered evenly. I have had considerable trouble from bad covering.

I have sometimes been rather "risky," so to speak, in planting early; but, if I can get the crop into market a few days earlier, the difference in price well pays for the risk. For example, I have sold from one piece, pease at three dollars a bushel, that four days later would have brought only seventy-five cents, as indeed more from the same vines did. At another time, I sold beans for a dollar and seventy-five cents per bushel, and within a single week could get only a dollar for the same crop from the same piece. I take two crops from all the land I can; and, if I have plenty of manure in the ground, this can be done with quite a number of kinds very well, — with beets, parsnips, and some other roots. I sow spinach between the rows, pease, early potatoes, and lettuce, followed by late cabbages, turnips, squash, &c. I market every thing from the field that I can. This saves harvesting, storage, shrinkage, and usually I get as good a price.

Some crops, like beets, will get too large for market, if left growing late. When at the proper size, I pull, dig a hole in the ground, and cover them with earth until time to store for winter. After getting vegetables into the cellar, I keep them as cool as I can until freezing weather, especially cabbages. Corn I always cut up, and stook. Think it is better. In taking care of crops, after planting, I keep all weeds down, if I can, as I cannot afford to buy manure to raise them. I cultivate all coarse crops, and hoe well. Hoeing is a trade, I find, with most men very poorly learned, especially for root-crops. One of my foremen said, that, after a shower, he moved one of the workmen's hoes back four rows, and the man began hoeing right along, not noticing any difference. I hire the best help I can find, and pay them the highest wages. I pay a man good wages if he is a good hand: if not, I pay him off. Let a man know that his money

is ready for him at any time, and he will work with a great deal more courage than if he expected to wait for his pay. The worst difficulty with help in my vicinity is on account of the easy access to the bar-rooms of the city; and many of the men being shoemakers, when that business is good, make it an excuse to leave, no matter how disastrous to the farmer. With regard to drink, I have had more trouble from this source than from any other, and have had to turn away many of the best workmen I ever employed, on this account. As I use liquor in no form myself, I will not have it used on the farm if I know it. I consider it one of the greatest curses in existence. I only keep what help I really need, and can always hire by the day in case of getting behind on my work. In the winter I draw a plan of all the land to be planted the next season, and mark out on each piece what I want it planted to. During the fall I also haul and heap my manure on the ground, for the crops, as far as I can, and put the manure on my asparagus and rhubarb beds, and generally clear up the fields for winter.

In winter I look over all carts, wagons, ploughs, chains, mowing-machines, &c., and get them repaired, ready for the next season. I keep an assortment of nearly every kind of bolts I think I shall need; so that, in case of any breaking, I do not have to go to the city to replace it. I keep duplicates of all parts of mowing-machines, tedder, &c., liable to break. This painstaking has saved me, in time, when wanted, more than twice what the parts have cost, especially in haying-tools.

Every farmer needs a set of carpenter's tools, saws, chisel, hatchet, hammer, &c., also an assortment of nails and spikes. I have all of my bolts, small tools, nails, &c., kept in a closet by themselves. A few dollars spent in this way pays a very high interest, besides saving the worry and perplexity of not having any thing to do with when a machine, or any other implement, is broken.

It would be greatly to the advantage of a farmer to spend a year of his early life under the instruction of a practical carpenter, so many are the calls upon one's ingenuity, and skill with tools, to keep in repair and construct the various implements to be used on a farm, also in building gates and fences. A word in regard to gates: they should be hung so

as to swing either way; this, quite often, is very convenient in teaming, and also saves time. I have always kept a year's stock of fuel on hand. I have a place under cover, where, in bad weather, I can have it cut, and in this way work in time that could not be as profitably spent otherwise. In felling trees, not having much woodland, I select the poorly shaped ones, leaving the best to grow.

I do my trimming on fruit-trees, when I can, from May 20 to June 20; if not then, in the fall. Scrape all apple-trees, and wash with strong soapsuds in the spring. In fact, the variety of work that can be attended to at nearly all seasons of the year is almost endless; and if the amount of time spent at the grocery-store, chimney-corner and other places, talking about what a poor business farming is, and what poor crops and poor season we have had, was passed in improving their places, many farmers would have a more productive farm, and more money in the bank, and we should hear much less of the old story that farming does not pay. A great loss, with some, is in not paying cash. I have made it a rule for twenty years, even if I was obliged to hire the cash, to keep some money in the bank, to be drawn out when wanted.

This I have found has always paid me a great per cent, better than stocks.

I run no grocery, butcher, or other bills; for I cannot afford it. I usually buy in large quantities, at wholesale rates. I should hire the money at twelve per cent, and pay cash, rather than get credited; for I find, with the best of clerks, errors will happen, but always in their favor.

I have been a constant reader, have got a great deal of information from agricultural books and papers, although, in most instances, a person must use his own judgment, and pick out and make use of the best of the information he obtains in this way. I have hardly ever hired a man from whom I could not learn something. I got my first idea of under-draining from a Scotchman and an Irishman, they having done the same kind of work in the old country. In planting in drills, especially mangolds, turnips, &c., I first got the idea from an Irishman in my employ; although I do not raise crops in that way, except pease, beans, and potatoes, unless I am short of manure. When I am thus short, I

can get nearly as large a crop from about half the amount of manure, because the crop is in direct contact with the manure. Vegetables, especially turnips, grown in this way, do not have as many roots as when the manure is spread broadcast.

I do not keep my farm accounts in a very systematic way; but I know they are correct, and were not entered for any other person's inspection. I keep a cash-book, diary, and farm-book, in which all sales each day are entered, and at the end of the year see what my expenses have been.

I take account of all stock on hand the first of January, and cast the balance. One sample only I will give, as all are similar; changes happening in valuation, higher prices paid, or from other causes. All stock, tools, horses, &c., are charged to the farm at the time of purchase. We will take the year 1863, it being the first year that the farm paid above the running expenses: —

FARM ACCOUNT.

Cr.	
Sold	$1,115 80
Twenty-six tons hay	376 00
Six tons fodder	48 00
Two hundred and ten bushels ears of corn	150 00
Nine hundred pounds pork	108 00
Fifty bushels potatoes	35 00
One hundred bushels carrots	20 00
Three barrels cider	12 00
Ninety gallons wine	90 00
Onions and beets	6 00
Sixty-eight pounds lard,	9 00
Seventy-one pounds bacon	10 00
Four bushels beans	10 00
Five shotes	50 00
Improvement on farm	$100 00
Ten cords manure	70 00
Garden-seed	15 00
Two acres and a half to grass	50 00
Broke up three acres	20 00
One month, man	25 00
Total	$2,319 80

Dr.	
Board of help	$169 00
Paid help	260 00
Standing grass	103 00
Interest on farm	180 00
Wear of tools, &c.	60 00
Two shotes	20 00
Taxes on farm	35 00
Total	$1,050 00

I have, since 1868, charged to the farm account, interest on eight thousand dollars, working capital. The first year on the farm, my sales were $263.94, and my expenses $464.25. I submit the account for each year since: —

	Dr.	Cr.
1860	$464 25	$263 94
1861	688 33	652 35
1862	836 16	693 67
1863	1,048 80	1,115 80
1864	1,371 00	1,945 50
1865	1,763 00	2,274 16
1866	1,647 70	2,595 43
1867	2,037 00	3,635 97
1868	2,387 00	3,086 00
1869	2,220 00	4,126 63
1870	1,160 00	4,166 46
1871	1,304 50	4,049 70
1872	2,900 00	4,370 17
1873	2,387 00	4,104 19
1874	1,473 50	3,217 40
1875	1,450 25	3,257 68
1876	1,733 00	3,085 90
1877	1,625 00	3,252 39
1878	1,268 00	3,539 39

The amount sold from the farm has averaged, estimating, for convenience' sake, three hundred days per year, $9.39 per day. First seven years, $4.56 per day. The last twelve years, $12.19. In 1863 I paid for labor $260. The highest amount paid in any one year was $634 in 1872. Have not done nearly the amount of farming I might; but have done all that I ought with my health and the amount of other business I had to do. The average expenses for running the farm, help, and board, interest, taxes, horses, harnesses, wagons, machines, and other outlays, for the nineteen years, was $5.22 per day, giving me $4.17 per day salary for nineteen years.

RECAPITULATION.

Cost of farm	$1.950 00
First house	550 00
Corn-barn, piggery	150 00
Repairs on barn	200 00
New barn	3.000 00
New house	7,000 00
Addition to barn	500 00
Improvement of land	6,000 00
	19,350 00
New household	550 00
Balance	$18,850 00

Nineteen years at $4.17 per day	$23,769 00
Horses, tools, wagons, &c., on hand	1.600 00
Amount	$25,369 00
Whole cost of farm	18,850 00
Balance over	$6,519 00

I may not be able to show you as large a bank account as some, but can show you — taking into consideration the condition of the farm when I bought it, the state of my health, my inexperience, sickness since I have been on the place, and the family I have had to feed, clothe, and educate, and many other drawbacks which I have encountered — forty acres of land in as good a condition as can be found in Essex County. The use to which I put one of my principal crops, namely, the hay-crop, I have not stated. I sell most of it, as I think that a more profitable way to dispose of it than to feed it out to stock. The price of milk is so low (and it does not pay to raise beef in the East), that I think it more profitable to sell hay, and buy manure. One ton of hay will make not far from one-half cord of manure; while the price of a ton of hay will buy nearly four cords of manure, or what eight tons of hay would make. I feed English hay only to my horses, using for my cows second crop and corn-fodder, refuse roots, &c. I keep only cows enough to eat up all unsalable feed, usually buying a few farrow cows late in the fall, and feeding them sufficiently, so that they can be sold for beef in the spring, their milk during the winter, paying for their keeping.

Having passed briefly through my barn and fields, and given you an outline of "my farm experience," leaving many important questions unanswered, as almost every farmer has his firmly-established theories, we will now adjourn to the house, in my estimation one of the most important appendages to a well-regulated farm. In my fifteen years' experience as a builder, I have seen many very important items, as regards comfort and convenience, overlooked by those who were planning for themselves or others a new house.

In building my house I have endeavored to get all the conveniences I could to make it as easy as possible for my wife to do her work. My house is thirty-three by thirty-eight feet, with an ell sixteen by forty-four feet, connecting with the barn. In the second story of the ell the rooms for my help are situated, on account of the convenience to the barn, and also leaving the main house for my own family. In the lower story of my ell are the carriage-house, wood-shed, and wash-room for the men. Under this latter apartment I have dug in the ground a circular cistern for rain

water, holding sixty hogsheads. This water is carried to a tank holding eight barrels, in the attic of the main house, by means of a force-pump. From the tank, pipes run to the bath-room, kitchen, and also to the basement of the house, for washing-purposes. Plenty of good water I consider one of the most important items on a farm. Beside household convenience, it is also a source of protection in case of fire. To the pipe leading from the tank a hose could be attached. The cistern and two never-failing wells keep me well supplied with water. In the cellar of the house, which I enter from the south on nearly a level with the bottom, I have my wash-room, with stationary boiler and soapstone wash-tubs. This room is separated by a brick partition from the remainder of the cellar. In one apartment, extending the whole length of the house, I keep a part of my vegetables, vinegar-barrels, and coal. The other room is for canned fruits, butter, and other household supplies. On the first floor of the house are located the dining-room and the kitchen on the south, with the parlor and sitting-room on the north or front. It will be seen by this arrangement of the kitchen and dining-room, the two living apartments of a farmer's family, that I have secured sunshine and warmth, and the pleasant cheerful influences, of these essentials to human health and happiness.

First, the kitchen: this room has received my special attention, because it is the domestic workshop; and I hold it true, that, if a farmer is worth a wife, she is worth every convenience, practical device, and utensil, to facilitate the doing of her work that it is within his power to obtain for her. On the easterly side of the kitchen is a case of drawers, which combines several conveniences. The case stands thirty-two inches high, is nine feet long and two feet wide: thus the top forms a table for all the many demands that are made in a kitchen for such a fixture. Beneath this table-top is a series of thirteen drawers, varying in size, as do the uses to which they are put vary from a table-cloth to a teaspoon. Upon the right of the table-top is a chest of small spice-drawers. On the northerly side of the room, each side of the chimney, is a large closet for dishes, measures, cooking-ware, &c.

Between the doors that lead to the wash-room and cham

bers in the ell is a small closet for the storage of boots and shoes, — things too often left "kicking around," to use an expressive phrase. On the southerly side are the force-pump and sink, the latter being supplemented with a drop-table, to be used when washing dishes. It is a trial of most women's good nature to wash floors, and it is a test of a builder's good sense to so construct the floors to be washed that they shall be easy to cleanse. This subject received my close attention, and I accordingly selected black birch as the material best calculated to answer the purposes named. I have found the selection a good one: black birch does not "grime;" nor does the dirt brought in upon one's shoes tread into it; it retains its smooth, glassy surface, and wears like iron. It should be laid in narrow strips, and blind nailed: treated thus, it will not curl or warp. In the dining-room, between the doors that open into the kitchen, I have built a sideboard (strictly a temperance one) for the accommodation of frequently-used table-ware, cloths, and other conveniences.

The parlor and sitting-room, which are upon opposite sides of the front-entry, are pleasant and large apartments; but we will pass up stairs to the chambers. These, the rooms in which most of us pass a third of our time, when we are tired, unconscious, and helpless, sustain to us a relation that no other rooms do; and it seems to me that they demand the best thought and care, both in regard to their comfort and their healthfulness. Only one of my eight chambers is less than fourteen feet square: all are well ventilated, so that a cross-current of air can circulate freely, without coming directly in contact with the sleeper. Besides this sanitary arrangement, the bath-room is an all-important accessory to a farmhouse, and in my family is duly appreciated as a luxury of no common account. No people need bathing as farmers do, to relax their tired muscles, cleanse their dusty bodies, and tone up their exhausted systems, preparing them for refreshing sleep, and assisting them to expel and repel sickness and disease.

In closing, it may be well to consider, by way of encouragement, some of the circumstances, misfortunes, and disappointments that led me to the farm. This allusion to trouble is made in no boastful spirit; but as nearly every one thinks his lot is the hardest, fraught with the greatest discourage-

ments, and filled with mishaps, losses, perplexities, and trials of all sorts and sizes, it will present my success in a more practical way, and strengthen the bond of fraternity between us, if I narrate in brief the darker side, drawbacks, and hindrances, — things that none of us escape, though meted to us in different measure.

As I mentioned at the beginning, my reason for taking a farm was extreme ill health, being told by an eminent physician that my life could not be prolonged beyond a few months. To this was added the embarrassments arising from large dealings in real estate, that, by reason of the financial panic of 1857, had proved unlucky investments. Beside *these* things was my utter ignorance of farming. What to do and how to do it, I had to learn. I bought an old run-out farm because I could get it cheap, and that was the best price I could pay. So shiftlessly had the farm been conducted, that the thick stone walls, the loose stones, and the rock that cropped above the ground, covered between four and five acres, or an area equal to about an eighth of the whole farm. The buildings were wholly out of repair. I had not the necessary farming-implements, nor the means to get them, only as the income from the farm enabled me to buy. My help was ignorant or wilful, or both. Every thing was experimental; and yet the family must be provided for. I trust these things, dark and forbidding to think of, may, after all, serve to stimulate others, as they do me, to patient, enterprising effort. Knowledge of soils, of seeds, and fertilizers, of stock, utensils, and methods, I have had to acquire. These things are invaluable knowledge, which has no price. The value of intelligent help cannot be overestimated. One of my chief hindrances, and most aggravating expenses, has been ignorant, careless help, that were constantly breaking machines, harness, or wagons, or in some way, alike discreditable to themselves and disastrous to me, drawing upon my patience and income.

It is seldom that the sorrows outnumber the blessings. It is not often, in New-England farming to-day, that the crops entirely fail, or the fields are barren; and I would not be unmindful of the thousand-fold of good that I have reaped from "my farm experience," — return of health and strength, a happy and instructive communion with nature,

and the profitable pursuit of an industry that supports all others, and has for its foundation the fertile earth. He has made his sure promise of the seasons in their turn, the never-failing recurrence of seedtime and harvest.

The meeting was then adjourned *sine die.*

Immediately after the adjournment of the public meeting, a meeting of the Board was held, at which the following votes were passed: —

Voted, That the cordial thanks of this Board be tendered to the Franklin County Agricultural Society and the Greenfield Farmers' Club, for the assistance they have rendered, and the hearty co-operation and sympathy they have manifested, in connection with these meetings.

Voted, That the Secretary be instructed to memorialize Congress, in behalf of the State Board of Agriculture, to take efficient measures to eradicate the disease known as pleuro-pneumonia.

CATTLE COMMISSIONERS' REPORT.

To the Honorable Senate and House of Representatives of the Commonwealth of Massachusetts: —

The Commissioners on Contagious Diseases among Cattle, in presenting their annual communication, are gratified in being able to report that no case of contagious disease affecting our neat-stock has come to their notice during the past year, and it is believed that none have existed. In consequence of the prevalence of contagious pleuro-pneumonia in adjoining States, there has been a feeling of unrest and apprehension on the part of stock-owners and the commission; and we have at different times been notified by the proper authorities of supposed cases of the disease. Examination, however, proved them to be simple pneumonia or tuberculosis. That there has been an outbreak of this contagion during the year in the States of Connecticut, New York, New Jersey, Pennsylvania, and Maryland, that it has made fearful ravages in some, and that it yet exists there, is

a fact which should have no concealment; nor the fact, that, by the ordinary trade in and transportation of cattle, it may be disseminated to all parts of the country. The States named have no laws sufficiently effective for its extermination; and it is doubtful if public opinion in the matter is strong enough to override political and party influences, and cause the enactment of the needed statutes.

Cattle and their products are the greatest agricultural interest of the country, and have a money value of many hundreds of millions of dollars; and their transportation to the seaboard, and thence to foreign markets, has become a commercial enterprise of vast proportions, with bright promise of unlimited expansion in the future. For increasing this trade, immense capital has been invested in land and transportation facilities, all of which is imperilled, if this disease is rife, or lurks anywhere in our domain. If through fraud, ignorance, or want of the most scrupulous care, it should be conveyed to the great ranches and pasture-grounds of the West, where these animals are reared in countless numbers, and where confinement or isolation is impossible, the immediate losses would be incalculable, and the destruction of the business total. The existence of the disease in the Eastern States is a continued menace to the Western stock-grower, and keeps him in constant apprehension; because, for the improvement of his herds, so that in quality they shall meet the demands of our foreign market, and return him the greatest profit, it is necessary they should have an infusion of the blood of our Eastern or the foreign improved breeds. If this can be done only by selecting the males from, or transporting them through, the infected districts of the East, the risk is too great to allow of the practice, and its benefits will be lost.

Already foreign governments within whose jurisdiction this trade finds its best market have become alarmed by existing circumstances, and are on the alert to prevent the reception of the disease from our exportations, and at different times have forbidden the landing of our stock, or compelled its slaughter at the places where it is unloaded; and they are now seriously discussing the question of prohibiting it altogether. To allay this apprehension, and, if possible, to prevent such a calamity, the United States Gov-

ernment has caused the inspection, before shipping, of all cattle sent abroad. One of our number has acted in this capacity for the port of Boston, under appointment of the treasury department; and it is believed to have been so efficiently done, that none have been sent from here in a diseased condition, or have been found infected with any disease on reaching their destination, except such as was contracted by foul air and hardships on shipboard. In the three departments of this business — production at the West, transportation facilities from there to Boston, and foreign shipment — many citizens of our State have a large pecuniary interest. The number of animals exported from Boston during the year ending Jan. 1, 1880, was 114,720; the value, $4,117,969. Of this number 35,555 were cattle having a value of $3,412,697.

But valuable as this trade is, or as it may become, there is imminent danger, that, from the causes named, it may be seriously interfered with, or broken up. The great work of our State in dealing with this cattle-plague in 1860, 1861, 1862, and 1863, proves beyond a cavil, that by properly directed effort, commensurate with the importance of the case, it may be entirely eradicated, "stamped out." But, unfortunately, though there is a common national interest in this matter, and all are imperilled nearly alike, State lines, State laws, and State rights (which pleuro-pneumonia does not regard) prevent *direct action* for its eradication by the General Government and the authorities of the States now free from the disease. Yet something may be done by both in the way of influence, and perhaps of compulsion, to arouse the States more immediately interested to the vital importance of the matter, and to decisive action.

The General Government can interdict or regulate the commerce in cattle to or from all infected States or districts, and thus confine it to its present locality; and other States, by memorials addressed to the governments of the States contaminated, may induce them to take measures for its eradication. The Commission would respectfully suggest that it may be the duty of the Legislature, as a measure of self-defence and public safety, to thus memorialize Congress and the different State governments.

The action of the Commissioners, under the statutes of

1879, pertaining to glanders and farcy, has disclosed the fact that these diseases are quite prevalent in the State, that the annual losses therefrom are very large, and that the general public are quite ignorant of their real character, tendency, and results. "They are probably widely diffused diseases, and have been known from the highest antiquity. It would appear, however, that some countries are more severely visited than others, and that they are those in which horses are most artificially maintained, and in which the laws of health are imperfectly observed, or altogether ignored.

"According to Léquistin, the disease was unknown in Mexico until the war between that country and the United States of America, in 1847, when the troops of the latter introduced it into Vera Cruz. It nevertheless appears to be rare in its new home."

"The term 'glanders' is applied to the disease when the nasal or respiratory mucous membrane and adjacent lymphatic glands, as well as the lungs and other organs are involved; and 'farcy,' when the malady is localized in the skin and subcutaneous connective tissue, and secondarily in the lymphatic vessels and glands.

"The two forms of the affection may be observed in the same animal singly, simultaneously, or successively; and the contagium of glanders may produce farcy by transmission from a diseased to a healthy animal, as farcy may produce glanders.

"Glanders and farcy (viewing them as essentially identical) belong, then, to a special diathesis, which, peculiar to the equine species (and in all probability to all solipeds), is only developed in it; though it is capable of transmission to various other creatures, either by direct inoculation, or by infection, being contagious, generally incurable, and, as a rule, fatal."

In addition to the widely diverse animals to which this contagious malady may be transmitted, mankind is also capable of receiving it.

VARIETIES.

Percival, in his work, "Hippopathology," vol. iii., 1838, devotes nearly two hundred pages to the subject of glanders, including farcy, which is recognized as the same disease, in which he recognizes five different varieties of glanders, viz., "acute, typhoid, pulmonary, sub-acute, and chronic." The acute, chronic, and pulmonary have been met with during the past year in this State. A brief description of the character

and symptoms of the malady, abstracted from the writings of eminent authors who have had great opportunities for investigation, is deemed of sufficient importance to insert in this report.

"ACUTE GLANDERS. — It commences with symptoms of slight febrile catarrhal disorder, and the fever attendant never quits the patient. The course of acute glanders is uninterrupted, oftentimes terrifically rapid, from the period of its attack to that of its surely fatal termination. The horse seems unwell, has manifestly lost the bloom on his coat, is unusually dull in his spirits and movements, does not feed with his ordinary appetite, evinces a sparing discharge from the nose of an unhealthy character, with submaxillary tumefaction, and this is followed by swelling of the nostril, chancrous ulceration, augmented and inspissated discharges, and appearances of farcy, — symptoms which day by day increase and extend, and at that rapid rate that puts an end to life, even so early as the second or third or fourth week."

"CHRONIC GLANDERS. — The pathological anatomy of this form differs but little from that of acute glanders, the separation of the two being merely arbitrary, so that one description would almost suffice for both.

"Their essential lesions are most frequently localized in the respiratory apparatus and those portions of the lymphatic system physiologically connected with it, though they may also be found in a great number of organs. These essential lesions are tubercles, chancres, lymphatic chords, and glands. The glanderous tubercles are always met with in considerable numbers in the lungs, and, according to Reynal, nowhere else.

"The chancres proper are to be found on the pituitary membrane of the nasal septum and the turbinated bones, and most frequently on one side, although they may exist on both sides, and even in the trachea.

"When the pustules of glanders are numerous in the nasal cavities, it rarely happens that the other parts, lungs, skin, &c., are seriously affected, and, when the lungs are gravely implicated, the nasal cavities are ordinarily little involved.

"In addition to the chancres proper, there are nearly always observed on the surface of the pituitary membrane, in chronic glanders, large superficial ulcerations due to the destruction of the epithelium: often a wide surface is involved, and particularly on the septum. . . .

"Though the character of the nasal discharge, the ulceration of the pituitary membrane, and the induration of the intermaxillary lymphatic glands, may be justly designated distinctive indications of glanders, particularly in the chronic form, yet it is by no means rare to meet with instances of what are termed 'internæ glanders,' in which one or all of these symptoms are absent. In this form, after death, the lungs may be found filled with numerous nodosities and tubercles, some in the gelatinous, others in the caseous, and others again even in the calcified condition, and varying in size from that of a pea to that of a nut. . . .

These cases are by far the most dangerous, as they offer no symptoms which might lead the expert to suspect the existence of the malady, and yet they readily infect healthy horses."

Fleming says, —

"Many outbreaks persist for months and even years, owing to horses affected with this occult form being allowed, through lack of knowledge, to remain alive, and associate with others. Regiments of cavalry, batteries of artillery, omnibus, cab, and other establishments, have been so haunted and ravaged for sometimes long periods; and the records of such events are numerous."

Zundel reports several instances, in one of which the disease had existed for a long time, causing much destruction, without any one being able to discover whence the infection came; slaughter of the diseased, and careful disinfection, producing no diminution in the losses. Zundel being called upon to consult with the veterinary surgeon who had the horses in medical charge, an inspection took place. A horse was found whose emaciation and unhealthy-looking coat gave rise to suspicion, though no outward sign of glanders could be detected. The animal was killed, and at the autopsy the lungs were discovered to be filled with soft, indurated, gelatinous, and caseous tubercles, — some recent, others quite old. Thus it happened that a horse which externally gave no indication of the malady yet infected a man and six horses. After it had been slaughtered, no other cases occurred at the mill.

"Causes. — Of all the contagious maladies affecting man or the domesticated animals, perhaps glanders is the disease which would be selected as an example of the spontaneous or direct development of a virulent or infecting element. . . . The highest continental veterinary authorities, and those who have most attentively studied the etiology of the affection, are absolutely unanimous in their opinion as to its being at times developed directly, and without contagion having any thing to do with it. . . . These causes are more or less of a kind that produce debility, and defective or perverted nutrition; and in this respect the disease resembles humera typhus."

Early in the present century the disease committed terrible havoc among the troop horses belonging to the British army. Professor Coleman, principal of the Royal Veterinary College, was directed to investigate the causes. The conclusions he arrived at were, "that the ordinary and almost

exclusive source of glanders and farcy was a poison generated in a confined atmosphere out of exhalations from the breath, the dung, the urine, and the perspiration of horses pent up in it." A thorough system of ventilation was established, the result of which was the almost entire immunity from glanders and farcy among the army horses.

The disease is very contagious in all its forms; an animal infected with it is always dangerous, though it may be full of life and constitutional vigor, and well able to labor. In its chronic form it is so similar to one or two other diseases of the horse, that it is difficult to diagnose with certainty. In suspected cases, isolation and time are necessary to determine the fact; and this makes all attempts in combating it costly to the State, and unsatisfactory to the owner of the animal. Many such cases have come under our hand during the year, one of which will exhibit this peculiarity. A horse belonging to the firm of Smith Brothers of West Springfield was reported to us by the proper officer as a dangerous animal. The examination showed a large and valuable horse apparently in perfect health, but with an enlarged submaxillary gland and a slight nasal discharge. It was a suspicious case, but not a pronounced one of glanders. Deeming him unsafe to go at large, he was isolated on the 13th of June. He was examined from time to time through the summer, but no material change was noticed in his general appearance, or in the progress of the disease. On the 4th of October the animal was in fine flesh and appearance, with only a slight glandular enlargement, or nasal discharge, and no perceptible ulcers on the septum; but he was condemned on account of the unmistakable glanderous character of the nasal matter. By the request of the owners, isolation was continued, but at their expense, until the 21st of December, when, though still in fine condition, he was slaughtered, and by an autopsy found to be in the condition determined on the 4th of October.

The whole number of suspected cases of glanders and farcy which have been placed in the care of the Board during the year has been sixty-nine. All did not prove to be such; but we have had occasion to order the slaughter of forty-three animals, and several have been killed by their owners, without expense to the State, on being informed that

their animals were glandered. Notwithstanding the large number of animals that have been thus disposed of, we do not feel justified in saying that at this date there is any abatement of the disease. In our work we have received the hearty co-operation of gentlemen of the veterinary profession, of municipal authorities, of boards of health, and other organizations, but have quite often found the owners of diseased horses engaged in schemes to conceal their animals, or thwart the action of the Board. Such conduct serves only to perpetuate the disease without benefiting the owner, is positively forbidden by law, and to prevent which the penalty as provided, of five hundred dollars or a year's imprisonment, appears not too severe.

As by law four-fifths of the appraised value of the horses slain, of the cost of isolation, of appraisal, killing, and burial, is paid by the State, the drafts upon the treasury by our year's work have been larger than was anticipated by the last Legislature. Our work, and, consequently, expenses, have been continued to date, and several recent items and bills have not yet reached the Board. The aggregate of those now approved amounts to the sum of $1,668.44. The appropriation for this purpose by the Legislature of 1879 was $1,000; of this sum about $207 was used to meet the deficiency of 1878, leaving but $783 to defray the expenses of 1879. The deficiency of the present year, when all bills now outstanding are presented, must aggregate the sum of $1,000, for the payment of which provision should be made; and if the work of combating glanders is to be continued, as appears desirable, a sufficient appropriation should be made to defray the expense.

LEVI STOCKBRIDGE,
E. F. THAYER,
H. W. JORDAN,
Commissioners on Contagious Diseases among Cattle.

BOSTON, Jan. 8, 1880.

ANNUAL MEETING OF THE BOARD.

The Board met at the office of the secretary, in Boston, on Tuesday, the 3d of February, 1880, at twelve o'clock, his Excellency John D. Long in the chair.

Present · Messrs. Abbott, Baker, Bowditch, Comins, Damon, Demond, Goessmann, Grinnell, Hadwen, Hersey, Knox, Long, Macy, Moore, Peirce, Phinney, Sessions, Slade, Smith, Taft, Upham, Wakefield, Warner, and Wheeler.

Voted, To adopt the order of business of the last annual meeting.

Reports of delegates accordingly being in order, Mr. Peirce reported upon the Essex Society, Mr. Demond upon the Middlesex North, Mr. Knox upon the Worcester South-east, Mr. Davenport (read by Mr. Grinnell) on the Worcester South, Mr. Smith upon the Hampshire, Franklin, and Hampden, Mr. Upham upon the Hampshire, Mr. Taft upon the Highland, Mr. Abbott upon the Hampden, Mr. Warner upon the Hampden East, Mr. Wheeler upon the Union, Mr. Damon upon the Berkshire, Mr. Hersey upon the Hoosac Valley, Mr. Wakefield upon the Housatonic, Mr. Comins upon the Marshfield, Mr. Grinnell upon the Worcester and upon the Middlesex South Mr. Phinney upon the Martha's Vineyard, and Mr. Slade upon the Nantucket,

These reports were laid upon the table. Professor GOESSMANN then presented his

SIXTH ANNUAL REPORT ON THE IMPROVEMENT OF THE SALT-MARSHES IN THE TOWN OF MARSHFIELD.

The dike has been in good condition during the past year: it has been widened on the west side by the town, and a road built over it at an expense of three thousand dollars, including the road to Brant-Rock Village. The extension of suitable ditches for draining the various parts of the marshes has not been carried forward as it would be desira-

ble in the interest of an increased production of well-paying crops. From five hundred to six hundred rods of good ditches have been added to those dug in previous years: more than one-half of that work was, however, accomplished by one party, Dr. Henry, who in the past year, as well as in previous years, has occupied a leading position in turning the reclaimed sea-marsh meadows to a proper account. Two and a half feet deep ditches were dug at an average expense of twenty-five cents per rod. About one hundred acres of land were ploughed for the second time, and from fifteen to twenty acres of new land has been added.

The sod of lands ploughed the second time was found thoroughly rotten: the soil resulting is in a good, pulverulent condition for seeding. The drained land is getting firmer from year to year: horses and oxen can conveniently travel in the furrow. The yield of hay has been less during the past season upon those meadows which had been seeded down with good grass-seeds after a mere harrowing of the old sod without a previous ploughing. The highly spongy condition of the old sod had favored the destruction of grass-plants by a severe drought toward the close of the preceding season, after a very satisfactory crop of hay had been secured. The uncertainty of cultivating a grass-crop by seeding on an old and spongy sod after a mere harrowing of its surface has received an additional striking illustration; the yield of English hay being only one-third that of the season of 1878.

The superior productiveness of a large portion of the reclaimed marsh-lands will not be duly appreciated until the plough shall have been effectually used to mix the different layers of soil and to secure that degree of compactness to the latter which is essential to protect the roots of plants against the influence of local extremes of the climate and the weather. Red-top and Timothy have been, as in previous seasons, the principal variety of grasses cultivated. Experiments with suitable mixtures of grass-seeds, recommended on former occasions, have not been successful on account of the dryness of the season: the seeds did not germinate and grow. Besides grass, corn, oats, onions, and potatoes have been the most prominent crops raised. Most of these crops have been planted mainly by parties who have leased the lands of the late Williams estate. Their success has been

somewhat impaired by a dry and stormy season. The corn suffered from strong winds; the potatoes rotted badly in the field; oats, onions, &c., did fairly. The grasslands looked well in the latter part of autumn; and the prospects for the spring are generally considered encouraging, as much preparation has been made to enter upon an active year.

C. A. Goessmann.

The Report was read, and laid upon the table for future action, when Mr. Ware presented the following essay upon

RECLAIMING SWAMP-LANDS AS TO PROFIT AND THE PUBLIC HEALTH.

The subject of reclaiming swamp-lands has been so often referred to in the reports of this Board, and so frequently discussed at its meetings, that I hesitate to attempt any thing more upon it; but the importance and value of improvements in this direction are so great, that it may be well to add line to line, and precept to precept, until the owners of swamp-lands become awakened to the value of money and labor judiciously bestowed upon such lands, as an investment yielding much greater per cent than United-States bonds or ordinary stocks. There are thousands of acres in Massachusetts of what are now wet, cold, boggy swamps, covered with bushes and hassocks: they fill the air with miasma, are an eyesore to the passer-by, a foul blot upon the face of the earth, and are of no value in their present condition. By a small outlay, compared with the results, they may be made the most productive lands that we have.

The first thing to be done in order to reclaim such lands is to lower the water-level by draining, commencing at the outlet, and making it as low as the location will allow, taking that as a base of a system of drainage more or less thorough, according to the situation. In order to illustrate the mode of operation, I will give two or three instances of successful reclaiming of swamp-lands. And first the method used on a swamp adjoining my own farm in Marblehead, which contains about six acres, and lies contiguous to a pond containing five acres. The water in the pond was some ten or

fifteen feet deep, and it had a very soft, muddy bottom of much greater depth. The swamp was composed of clumps of blueberry and other bushes, brakes, and brambles; and when the water was high it was necessary to jump from one clump of bushes to another to get through it, while the outer edge and dryer portion had formerly been used as a peat-meadow, and cut into ditches for the purpose of procuring fuel; the whole presenting an appearance as forbidding as could well be conceived of for agricultural use. The outlet of the pond was an open ditch, passing first over a gravelly bar, and then through a peat-meadow, where the peat was from four to ten feet deep, with a fall of about three feet in seventy-five rods.

The first thing done was to begin in August, when the water was low, at the lower part in the outlet, and dig a ditch back towards the pond, as near level as would be safe; that is, allowing three inches' fall to a hundred feet distance. In this ditch was placed a box-drain made of two-inch hemlock plank for sides, and two thick pieces of one-inch board across the top and bottom, with one foot area. This box-drain was continued all the way to the pond, and finally covered with the material dug out of the ditch. This drain lowered the water of the pond and the whole of the swamp three feet. This reduction of the water left a strip of flats uncovered all around the pond, of from ten to twenty feet in width, and caused the coarse, porous muck of the swamp to settle some eighteen inches, and consolidate somewhat. The bushes were cut; the clumps of roots and hassocks were tumbled into the peat-ditches and around the pond to extend the breadth of land to the water. A ditch was dug around the outer edge of the swamp, four or five feet deep and three feet wide, and filled half full with stones, and covered about two feet: this made an efficient drain to cut off any spring water coming from the high land, and disposed of a large quantity of stones that were in the way. Other ditches were dug of the same size, from the box-drain across the peat-meadow before spoken of, filled with brush, tramped down, and covered over. The peat dug out of these ditches was worth more than the cost of digging, either for composting, or for filling parts of the swamp where needed.

The next winter, gravel was hauled from a bank near by,

and spread on three inches deep; also manure dumped, a load in a place, as near as would be needed. Potatoes were planted the next season, producing a fair crop. Early in September it was laid down to grass; and for nine years, with a topdressing once in three years, it yielded from four to five tons of good hay per acre yearly, including first and second crops. At that time the sod became somewhat enfeebled; and, after haying, it was ploughed up by attaching the plough to the forward axle of a wagon, thus allowing the cattle to walk on the grass-sod. The same work may now be done with the Oliver Chilled Plough without the wagon-wheels. The land was manured, and again laid down to grass.

For another nine years it has continued about the same yield, with occasional top-dressing: now it begins to show the need of renovating again, which will be done the coming season, as before. The cost of reclaiming this swamp was seventy-five dollars per acre, which may be considered as the price of the land, as the improvement is for all time, and the interest only should be charged against the products as an investment. Now, instead of an unsightly, unhealthy morass, inhabited by frogs, snakes, and crows, it is like a beautiful lawn in appearance, yielding two bountiful crops of hay annually, and a very profitable part of a profitable farm, at a cost of four dollars and a half interest per acre, considering the improvement as an investment.

There are a few important points connected with this improvement, to which I desire to call attention: first the box-drain as an outlet to the pond. This drain, being always wet, and usually under water, will not decay; and, being covered, saves a strip six or eight feet wide, of very productive land, and also the labor of frequently cleaning out an open ditch. Second, the stone drain around the edge of the swamp serves the important purpose of cutting off all the water that would flow or soak into the swamp from the surrounding high land; and over it a much larger crop grows than anywhere else. If stones can be disposed of in any other way to advantage, it is cheaper to lay tile-drains than to use them, even if they are very near, because so much less breadth of digging is required. The character of the peat is so coarse and porous, that it allows the rainfall to soak readily through it, rendering other drains comparatively

unnecessary, which, if of a more tenacious character, would have been necessary. Third, the ditch across the peat-meadow (which was more compact and tenacious) to the box-drain, filled to within two feet of the surface with brush (which, being always wet, will not decay), took the place of a large quantity of meadow-mud suitable for composting, and at the same time made an efficient drain at small cost, as the contents of the ditch were worth more than the cost of digging.

The above-mentioned improvement was made by Horace Ware, a practical farmer of Marblehead. Three years ago he purchased a part of a farm containing another pond of three acres, surrounded by a swamp varying from one to two hundred feet in width, covered with trees and bushes, except on the side where a small stream or ditch emptied into the pond, after running through a piece of swamp-land containing about two acres, covered with coarse rushes and small bushes. The outlet of the pond was over a gravelly bar. The improvement of this swamp was begun by digging through the bar to a sufficient depth to lower the water of the pond about three feet, leaving a margin of flats around the pond, as before, of ten or twenty feet in width. The trees were cut into cord-wood; the bushes cut and burned; and the stumps and clumps of brush-roots were dug up, and tumbled into the margin of the pond, to increase the breadth of land. A box-drain was placed in the inlet running through the two-acre portion of the swamp, deep enough to be covered two feet. This portion of the swamp, after the small bushes were mowed, was ploughed by attaching a rope long enough to allow the four-ox team to be driven on the high land; at the end of each furrow the plough was carried by three men back across the swamp for the next furrow: in this way, with a large plough, it was completely ploughed.

The next winter, gravel was carted from a bank near, and spread on three inches deep; and ten or twelve cords of manure per acre were carted on. The next season it was sowed with mangel-wurzels, which produced a crop of sixty tons per acre, worth enough to pay for all that the whole improvement had cost, including the cost of cultivating the crop. The land, after harvesting the mangolds, was laid

down to grass, and the last season yielded, in the two crops of hay, five tons per acre, and there is a reasonable prospect of an equal amount for three or four years: with a top-dressing, a continuance for as much longer time.

It may seem almost incredible that the first crop on this land should have paid the whole cost of the improvement and cultivation of the crop. But when we consider the very favorable location, the narrow breadth around the pond (which made the clearing of the clumps of roots from it easy), the character of the other portion that could be ploughed in the way described, and that the porosity of the peat was such as made no other draining necessary, except the lowering the outlet of the pond, with a gravel-bank close at hand, and most of the labor being done at a season when other work was not pressing, it may not appear so strange; and yet this swamp was located in the centre of a large farm within twenty rods of the front of the house, with all of the opportunities described, and no attempt to reclaim it until now. Four acres of the most productive and profitable land has taken the place of an unsightly, unhealthy, worthless morass, and at no cost; for one crop paid all expenses.

I have no doubt there are hundreds of opportunities as favorable as this in Massachusetts; and yet there are persons, even calling themselves farmers, who say that farming does not pay. I now desire to call attention to another swamp, of an entirely different character, requiring as different treatment in reclaiming, which is a part of the same farm as the last. The swamp that I now describe contains about twenty acres, and was purchased five years ago, by Addison Childs, Esq., who constructed a system of thorough drainage. This swamp is nearly level, and has a surface of about eight inches deep, lying upon a bed of hard-pan gravel, with some clay intermixed. Many years ago the bushes were cleared off, and an attempt made to reclaim it by a system of shallow open drains. Water usually standing within a foot of the surface, the soil was in a cold, sodden, sour condition, and baked and cracked in time of drought. The yearly production of this land per acre was only ten or fifteen hundred-weight of a poor quality of hay.

Mr. Childs first had a complete system of drainage laid out by a competent engineer, which is an absolute necessity on a

large tract of land that is nearly level or of an uneven surface, as success depends upon a regular fall of not less than three inches in a hundred feet distance, or more, if possible, and as much regularity in the fall secured as the location will permit. He obtained, by blasting in a ledge, an outlet some six feet below the surface, which, with the natural fall of the land, gave him sufficient fall for his drain. He used the round tile with collars, which is the best kind in use. A wide, open ditch, with sloping banks, which are now grassed over and can be mowed, was dug the whole length of the meadow, at the bottom of which he sunk a box-drain, eighteen inches square in area, made of two-inch plank: this drain is four or five feet below the surface, and covered over, so that grass grows on the whole surface of the open drain. The box-drain is designed to take the natural flow of a small brook that always flowed through the meadow, and also serves as the main drain for the whole system of tile-drains. The open drain over the box-drain serves in times of freshets to convey the surplus surface-water.

In most land of this character the tile should be laid as near four feet deep as the nature of the lay of the land will permit, and in parallel lines forty feet apart. Some portion of so large a tract of land as this may require two-inch pipe for the lateral drains; but ordinarily an inch or an inch-and-a-quarter pipe is sufficient to convey the rainfall in as short a space of time as is desirable. All water flowing into the meadow from adjoining high lands or springs should be provided for by a cut-off drain running along the border, which may be connected with the lateral drains running to the main drain. With the lateral drains forty feet apart, it would require about eleven hundred feet of tile per acre, which would allow for ordinary breakage. In average digging, an experienced man will dig the trench, and lay about three rods per day. No care need be taken to cover the tile with any porous substance, as the water flows into the tile from the bottom, rather than from the top, except immediately over the tile; but in case of quicksand, the tile should be embedded in clayey or tenacious soil to keep the sand out of it. With tile properly laid, and with silt receptacles at proper places, a drain will keep in order for any length of time; so that the first cost of this system of drainage may be

considered the amount of the investment, which would ordinarily be from fifty-five to sixty dollars per acre.

I do not propose to go further into the details of laying tile-drain, having only suggested some general principles, as no one should attempt thorough drainage (except on a small, scale and where a simple system only would be necessary) without the aid of experience and competent engineering. Mr. Childs's system was substantially conducted as indicated above, and has proved a complete success; for after ploughing, manuring liberally, and sowing down to grass, the land has yielded two heavy crops of hay per year, and, with an occasional top-dressing, will continue to do so for a long time. A careful, observing farmer of good judgment, who owns an adjoining farm, has said that the lot of thirty-eight acres, of which this meadow is a part, is worth more as a farm since it has been drained than the whole two hundred acres which included this meadow was worth before the improvement; and I have no doubt of it myself.

I wish to call attention to one other swamp, of an entirely different nature from either of those described, which has been drained with very profitable results. In the town of Arlington there is a large swamp, covered with maple and other trees, the roots of which do not run deep on account of the water-level being within eighteen inches of the surface. The upper end of this swamp is owned by a market-gardener, who has cut off the wood, and dug up and burned the stumps and roots. The peat here is of a fine compost quality. Several acres have been drained by the use of sole-tile laid on strips of board, as low as the level of the water will permit. These drains, being necessarily shallow, are laid nearer together, so that the rainfall is rapidly disposed of. So much of this swamp as has been underdrained has been very profitably used for the last twelve or fifteen years for the production of market vegetables, especially for celery; while the rest of the swamp remains of no value, except for the wood that may be on it.

To show how underdraining forwards land in the spring for cultivation and growth of vegetation, by allowing air to take the place of water, and the warmth of the sun to enter the soil, instead of being carried off by evaporating the water which the drains take away, I will state my own experience.

I have two acres of naturally very strong, rich soil, resting on a clay-bottom with a gradual slope, which, before being underdrained, was very wet, and could only be cultivated late in the season: one half of this is underdrained, and the other half not. Last March, when the frost was out about four inches, I sowed oats (the land having been ploughed in the fall), and dragged them in. As the spring advanced, the oats were up two inches high on the part thorough drained, before they made an appearance on the undrained portion; making an interesting and valuable experiment.

Instead of advancing theories, I have endeavored to describe the actual results of reclaiming swamp-lands of entirely different character, and by different methods well adapted to the different conditions; all of which are shown to be very profitable improvements as investments of capital in farming operations. And, what is of vastly more importance, an unhealthy, miasmatic, unsightly portion of the farm can be converted into life-sustaining and beautiful fields by a system of thorough drainage. No one questions the propriety of placing sufficient authority in the Boards of Health in cities and towns to abate sources of disease by drainage or otherwise. At the West, county commissioners have power to lay out and build public drains in fever-and-ague districts, for sanitary and agricultural purposes. How soon Boards of Health may be required to step outside the limits of cities and towns, and require such improved conditions, remains to be seen.

When, as has been shown, the farmer's pecuniary interest is so surely promoted, and the sanitary condition of his farm and neighborhood may be so evidently improved, it would seem that duty to himself and family imperatively demands of him who owns such swamp-lands, that such improvements should be made. My experience in draining, and observation of the experience of others, have established in my own mind the following principles or maxims, which may be of value to others. The best and most durable and economical drains are made with tile laid four feet deep and forty feet apart. Let no one, however, refrain from draining if the outlet cannot be made low enough for this depth. I have had profitable results with drains laid only fifteen inches deep. The round tile with sockets are the best; sole-

tile are the next in value; the horseshoe-tile are less desirable, and are now used but little. No soft-burned tile, or those with the ends melted or over-burned, should be used, or received by the purchaser. A whole line of drain may be obstructed by a single imperfect tile. Stone drains are more costly than tile, even if the stones are near at hand, on account of the additional digging required, unless the material dug out is valuable for other purposes, and the stones used are to be disposed of as a nuisance. Such a drain may be serviceable for many years, but will in time become choked up.

An efficient and serviceable drain may be made in a peat-swamp, where the material dug out is of value, by tumbling in brush as high as the water-level, and covering with coarse sod first, and then with the finer portions of the muck. For very wet swamp of soft muck, a cheap and durable drain may be made with three pieces of board, three or four inches wide, nailed together in a triangular form. As a general rule, drains should be laid in the line of the greatest fall, and of a regular descent; that is, if the upper portion of a drain has a fall of two feet to a hundred, and the lower portion one foot or less, the last would suffer more from silt than if the whole were uniforn. But circumstances may require some deviation from either of these rules.

Silt deposits should be constructed in long lines of drain. As the greatest cost of draining is in digging the trenches, care should be exercised against digging them wider than necessary. Fifteen inches wide at the top is usually sufficient; while an inexperienced man would make it two feet or more, thereby adding much to the cost. And finally, where corn is worth fifty cents per bushel, under-draining may be undertaken with a good prospect of a profitable investment.

BENJAMIN P. WARE,
Chairman of the Committee.

Voted, To appoint a committee of three to examine and report upon the credentials of newly-elected members: Messrs. Slade, Hersey, and Macy.

Voted, To sanction the change of time of holding the exhibition of the Martha's Vineyard Agricultural Society tc Oct. 7 and 8 for the year 1879.

Mr. Hersey, on behalf of the committee appointed to examine and report upon the general exhibit at Greenfield in connection with the country meeting Dec. 2, 3, and 4, submitted the following

REPORT.

In submitting their report, your Committee desire to say that the Committee of Arrangements for holding the meeting had not caused the exhibits to be properly entered or arranged; so that they found it impossible, in the short time assigned them, to gather up the information necessary to make a full and correct report. While some exhibits were without names, others were so covered up that undoubtedly some escaped notice.

The Committee would suggest, that if exhibitions are to be held in connection with the public meetings of the Board, and are not to be under the management of the Committee of Arrangements, that a special committee be chosen or appointed in time to give them an opportunity to see that every exhibit is properly entered and arranged.

John F. Brown of Lunenburg exhibited very fine samples of the Pell Apple, Newtown Pippin, Yellow Belle Fleur, Æsopus Spitzenburgh, Washington Royal, &c., all very fine specimens, large, and well matured; also a plate of peaches in a good state of preservation. D. N. Carpenter exhibited specimens of barley, oats, Swede turnips, and potatoes; Z. Smith of Greenfield, specimen of wheat, and trace of Indian corn; W. E. Stoughton, apples, pears, carrots, parsnips, squashes, turnips, and several varieties of beets; S. C. Severance of Leyden, two varieties of beans, collection of vegetables, and trace of corn; Oscar Bardwell of Shelburne, beans, oats, and rye; E. G. Ames of Greenfield, oats, pumpkins, and Swede turnips; George Jones of Deerfield, box of very nice wheat; Francis Howland of Conway, Chinese hulled oats, weighing fifty pounds to the bushel; R. A. Nims, Deerfield, white wheat, very good; H. W. Wood, apples, white wheat, and potatoes; Lewis D. Wolf of Deerfield, buckwheat; —— Wells of Shelburne, two varieties of oats; A. Peck of Shelburne, apples, red potatoes, and turnips; H. Miller, squashes, cabbages, turnips, &c.; E. N. Reed, box very large cranberries; E. Bushnell of Deerfield, several

varieties of vegetables; H. C. Haskell, Dent corn from Michigan, grown in a hundred days, well ripened; —— Parmenter of Greenfield, red onions, potatoes, trace of very good corn; J. S. Grinnell of Greenfield, collection of grain and vegetables; Elias Bardwell of Coleraine, six varieties of apples, very fine specimens; T. J. Field, several traces of corn, specimens of wheat, beets, &c.; J. A. Hawkes, collection of vegetables; R. Campbell, broom-corn brush and seed; H. C. Haskell, Havana tobacco; J. M. & C. K. Smith of Sunderland, broom-corn seed, and Indian-corn twelve-rowed; George N. Smith, oats and barley; W. Bardwell of Montague, sweet-potatoes, very large and fine; E. C. Hall, oats, very good; C. M. Cobb, Springfield, specimens of pumpkins; S. W. Frary of Greenfield, two traces of corn; T. Metcalf of Northfield, tobacco; F. H. Williams, beets and onions, the latter good; John B. Moore of Concord, onions, beets, turnips, and potatoes. The onions approached very near perfection.

Three bundles of wool were exhibited without a name.

The exhibition, as a whole, was very good, and would have attracted more attention if the articles had been properly arranged.

Respectfully submitted.

EDMUND HERSEY.
JOHN B. MOORE.

The Board then adjourned to ten o'clock on Wednesday.

SECOND DAY.

The Board met at ten o'clock A.M., his Excellency Gov. LONG in the chair.

Present: Messrs. Abbott, Anderson, Bowditch, Brown, Damon, Demond, Gleason, Goessmann, Grinnell, Hadwen, Herrick, Hersey, Long, Lynde, Macy, Mayhew, Moore, Nichols, Perkins, Pierson, Sessions, Slade, Taft, Varnum, Wakefield, Ware, Warner, and Wheeler.

Mr. SLADE, for the Committee on Credentials of newly-elected members, submitted the following

REPORT.

The Committee on Credentials, to which was referred the credentials of newly-elected members, respectfully report that they have attended to the duty assigned them, and find the following duly elected: —

A. C. Varnum (of Lowell) . . .	by the *Middlesex North Society.*
Dr. J. P. Lynde (of Athol) . . .	" *Worcester North West.*
Samuel N. Gleason (of Warren) .	" *Worcester South.*
Flavel Gaylord (of Amherst) . .	" *Hampshire.*
Henry K. Herrick (of Blandford) .	" *Union.*
John S. Anderson (of Shelburne) .	" *Franklin.*
Augustus T. Perkins (of Cotuit) .	" *Barnstable.*
David Mayhew (of North Tisbury) .	" *Martha's Vineyard.*

Marshall P. Wilder, appointed by the Executive.

(Signed) Avery P. Slade.
For the Committee.

The Report was accepted.

Messrs. Grinnell, Wheeler, and Mayhew were appointed a committee to nominate two members of the Examining Committee of the Massachusetts Agricultural College.

Messrs. Wakefield, Sessions, and Anderson were appointed a committee to report upon the assignment of delegates.

Messrs. Ware, Slade, and Goessmann were appointed a committee to consider and report a list of subjects for investigation, and the assignment of committees upon them.

Messrs. Moore, Demond, and Hersey were appointed a committee to consider and report upon the time and place of holding the country meeting.

Messrs. Baker, Taft, and Warner were appointed a committee to consider and report upon changes in the times of holding fairs.

Mr. Hadwen then reported as delegate upon the Middlesex Society, Mr. Brown upon the Worcester North-west, Mr. Bowditch upon the Franklin, Mr. Ware upon the Deerfield Valley, Mr. Pierson upon the Hingham, Mr. Vincent (read

by Mr. Grinnell) upon the Bristol, and Mr. Baker upon the Barnstable.

Dr. NICHOLS, Chairman of the Examining Committee of the Massachusetts Agricultural College, then submitted the following

REPORT.

The duty assigned to me the present year, of visiting the Agricultural College at Amherst, and conducting the examination of the senior class, was pleasant, and also encouraging as regards the usefulness of the institution.

The College has labored under some peculiar difficulties and discouragements in the present and past years, owing to the want of means to carry forward the work of the institution as planned by its officers. The graduating class was found to be small, numbering only seven; but their appearance and acquirements were certainly very creditable. The examination was conducted with the view of obtaining as clear an insight into the results of the practical workings of the College as possible; and every facility was afforded by Professor Stockbridge and others that could be desired. For a period of nearly or quite three hours the young men of the class were under examination; and the questions put to them were such as must of necessity call out answers to be made promptly, without the aid of books or instructors; and the results were highly gratifying.

A prominent aim was to ascertain if the young men were really qualified to go upon a farm, and conduct its operations in an intelligent and practical manner. It was deemed desirable to learn if they had been instructed in a way to enable them to carry forward the principles of advanced husbandry so as to promote its best interests wherever they might be located. This requires a knowledge of the principles and practice of chemistry, also an acquaintance with the physical character of soils, their origin, and methods of reclamation and fertilization; the nature and nutritive value of the cereal grains, roots, and grasses; the value of the different breeds of animals, and the best methods of feeding and utilizing their products; the care of seeds; and all the implements of husbandry. Upon these points and many others the young men were examined sufficiently in detail to

bring out what they really knew; and it is gratifying to report that the answers showed marked proficiency in these departments of study. They were such as to increase our confidence in the usefulness of the College in its direct bearings upon the agriculture of our state and country.

The gentlemen of the State Board associated with me in the examination — Messrs. Brown, Moore, Slade, and Bowditch — fully coincide in the views here presented.

JAMES R. NICHOLS,
Chairman.

HAVERHILL, MASS.

The Report was accepted.

MR. WARE offered the following preamble and resolutions as embodying the sense of the Board in regard to the proposition made by Gov. Talbot and his Council to unite the Massachusetts Agricultural College with Amherst College: —

Whereas the National Government gave to the several States in the Union public lands for the purpose of endowing agricultural colleges; and

Whereas the gift of three hundred and sixty thousand acres of land was accepted by the State of Massachusetts from the government, and the sum of seventy-five thousand dollars was raised by the town of Amherst to increase the endowment, and large sums of money were given by private individuals solely for the purpose of an agricultural college, independent of any other institution of learning; and

Whereas it was expressly understood and settled that the Agricultural College must be an institution solely for the purpose of instruction in such branches as would secure a scientific agricultural education, and a knowledge of military science and tactics; and

Whereas the Governor and Council were requested by the Legislature of last year "to report some plan for the permanent continuance of said College, with its relations to the State definitely fixed, or some plan for its discontinuance, but with the provision, in any event, that its finances shall from this time be finally separated from the treasury of the Commonwealth," and have reported the expediency of uniting the Agricultural College with its endowments and property to Amherst College: therefore

Resolved, That, in the opinion of the members of the State Board of Agriculture here assembled, the interest of the agriculture of Massachusetts would not be promoted by such transfer, and that we protest against such disposition of it.

Resolved, That as, since the re-organization of the Trustees and Faculty of the Agricultural College, it has been managed successfully as an educational institution, and its expenses kept within its income, we therefore hope that it may remain as it is, and was originally intended, independent of any other institution.

The resolutions led to a lengthy discussion, in which many members of the Board participated; after which they were unanimously adopted by a rising vote.

On motion of Mr. GRINNELL, it was

Voted, That every agricultural society receiving the bounty of the State be required to offer annually fifty dollars in premiums for agricultural experiments to be tried under the direction of this Board, and to report upon the same in their published Transactions of the same year.

Voted, That a committee of five be appointed by the Chair, who shall prepare and assign these trials to different societies, regard being had to the productions of different localities and their adaptability to the same; said committee to report thereon to-morrow, — Messrs. Grinnell, Moore, Wheeler, Hersey, and Sessions.

The report of this committee, with a plan for experiments as suggested by them, will be found on a subsequent page. As many of the societies had already issued their premium-lists, it was understood that they would be requested to comply so far as possible this year, and that the requirement will not be made till 1881.

Voted, That a committee be chosen with instructions to use all proper means to secure such changes in the dog-laws, as in their opinion will better protect the owners of sheep and other property, — Messrs. Hersey, Grinnell, and Wakefield.

Messrs. Wheeler and Lynde were nominated and confirmed as members of the Examining Committee of the Agricultural College.

Professor GOESSMANN, State Inspector of Fertilizers, then submitted his

SEVENTH ANNUAL REPORT ON COMMERCIAL FERTILIZERS.

To the Massachusetts State Board of Agriculture.

GENTLEMEN, — The beneficial influence of our laws regarding the sale of the various commercial articles used for the fertilization of our farm-lands becomes more manifest from year to year. A well regulated competition stimulates here, as elsewhere, a healthy business enterprise, and ultimately benefits all parties concerned. The trade in commercial fertilizers has been quite active during the past year. The general character of most of our compound standard fertilizers has been, on the whole, quite satisfactory. These articles have of late been steadily improving so far as their mechanical conditions are concerned, and are in many instances well qualified for a desirable uniform distribution to secure a speedy, efficient action. Coarse mixtures containing large proportions of insoluble ingredients are of an exceptional occurrence.

The wholesale market-price of the various brands of compound fertilizers at the depots near the factory is more generally found to correspond with the cost of their constituents in the general market. The fluctuations in the price of most substances turned to account for fertilizing purposes were but slight during the spring; and no material changes in that direction have been noticed during the fall, with the exception of that of Chili saltpetre. The war between Chili, Bolivia, and Peru, has of late more or less interfered with the importation of that article. Although the varieties of compound fertilizers offered for sale in our State have not diminished in numbers to any marked extent, it is not less a fact worthy of notice, that more dealers have engaged in the sale of chemicals, indicating an increased demand for these substances on the part of intelligent farmers, to supplement their home resources of manures. This new feature

in our fertilizer trade is, no doubt, a most encouraging sign that the principles of rational manuring are becoming better understood, and, in the interest of good economy, more generally applied.

One case of a violation of the laws for the regulation of the trade in fertilizers, by selling without a license, has been reported to the secretary of this Board, for action in the courts. From sixty-five to seventy analyses of fertilizers are reported in the subsequent pages.

The following prices have been adopted in their valuation; except in those cases where nitrates, actual ammonia, or sulphate of potassa, have been mentioned by the manufacturer.

	Price per pound, in cents.
Soluble phosphoric acid	12
Reverted phosphoric acid	9
Insoluble phosphoric acid	6
Nitrogen in organic matter	20
Potassium oxide	4

Ruling Market-Prices for the Year 1879–80. *Boston, New York.*

I.

	Price per pound, in cents.
I. *Nitrogen.* In form of ammonia and nitric acid, from	24 to 25
In form of dried ground meat and blood, finely-pulverized steamed bones, finely-ground fish-guano, Peruvian guano, urates, poudrettes, and artificial guano	20
In form of finely-ground bones, fine-ground horn, wool-dust, bat-guano, &c.	18
In form of coarsely-ground bones, horn-shavings, woollen rags, human excretions and barnyard-manure, fish-scraps, animal refuse-matter from glue factories and tanneries, &c.	15
II. *Phosphoric Acid soluble in water.* As contained in alkaline phosphates and superphosphates	12
In Peruvian guano and urates	9
In form of so-called reduced or reverted acid	9
In precipitated bone-phosphate, steamed fine bones, fish-guano, according to size and disintegration, from	6 to 7
In form of bone-black waste, wood-ash, Caribbean guano, ground bone-ash, coarsely-ground bones, poudrette, barnyard-manure, &c.	5
In form of finely-ground South-Carolina and Nevassa phosphates	3.5

	Price per pound, in cents.
III. *Potassium Oxide.* In form of muriate of potash or chloride of potassium	4
In form of sulphate of potassa in natural and artificial kainits, from	6 to 6.5
In form of higher grades of sulphate of potassa, from .	7.5 to.8

II.

NAME OF MATERIAL.	Price per ton of 2,000 pounds, in dollars.	Price per pound in case of from 100 to 200 pounds, in cents.
Sulphate of Ammonia, containing from 24 to 25 per cent of ammonia	90–95	4.5–5
Nitrate of Soda (Chili saltpetre), containing 95 per cent of that compound (April) .	75–80	3.5–4
Nitrate of Soda (Chili saltpetre), containing 95 per cent of that compound (December).	97.50–104	4.875–5.25
Nitrate of Potassa, containing 94 to 96 per cent of that compound	160–170	8–9
Dried Blood, yielding from:—		
(*a*) 12 to 14 per cent of ammonia . .	50	2.5–3
(*b*) 10 to 12 per cent of ammonia . .	45	2.8
Dried Meat, yielding from 14 to 15 per cent of ammonia	50	3
Fine-ground Bones, containing from 22 to 24 per cent of phosphoric acid, and yielding from 3.5 to 4.5 per cent of ammonia .	35–40	2.5
Bone-black (waste material), containing from 30 to 34 per cent of phosphoric acid .	28–30	1.5
Superphosphate of Lime, containing from 15 to 16 per cent of soluble phosphoric acid .	32–35	2
No. 1 Peruvian Guano (Standard or Guanape), containing from 12 to 15 per cent of phosphoric acid, 10 per cent of ammonia, 2 to 3 per cent of potash	56	3
No. 1 Peruvian Guano (Lobos), containing from 15 to 20 per cent of phosphoric acid, 6 to 7 per cent of ammonia, 3 to 5 per cent of potash	47–50	2.5
No. 1 Peruvian Guano (guaranteed), containing:—		
11.50 per cent of ammonia, 17.10 per cent of phosphoric acid, 2.30 per cent of potash	70	7.4
6.30 per cent of ammonia, 18.70 per cent of phosphoric acid, 3.20 per cent of potash	56	5.9
No. 1 Peruvian Guano (rectified or soluble), containing 9.70 per cent of ammonia, 14.25 per cent of phosphoric acid, 2 per cent of potash	69	7.3
No. 2 Peruvian Guano, containing 3 per cent of ammonia, 15 per cent of phosphoric acid, 2 per cent of potash . . .	38	4

NAME OF MATERIAL.	Price per ton of 2,000 pounds, in dollars.	Price per pound in case of from 100 to 200 pounds, in cents.
Muriate of Potash, containing from 80 to 85 per cent of that compound, equal to from 50 to 53.7 per cent of potassium oxide .	35–40	2
Muriate of Potash (Douglasshall), containing 80 per cent of that compound, equal to 50 per cent of potassium oxide and about 10 per cent of sulphate of magnesia . .	40–45	2–2.5
Sulphate of Potassa, containing 80 per cent of that compound, equal to 43.3 per cent of potassium oxide	60–65	3.5–4
Sulphate of Potassa, containing from 60 to 65 per cent of that compound, equal to from 32.3 to 35 per cent of potassium oxide .	55–60	3–3.5
Sulphate of Potassa, test 40 to 60 per cent of that compound, equal to 22 to 38 per cent of potassium oxide. Standard contains 50 per cent of sulphate of potassium, equal to 27.5 per cent of potassium oxide .	35	2
Domestic Sulphate of Potassa, containing from 65 to 70 per cent of that compound, equal to from 35 to 37 per cent of potassium oxide	52	3
German Potash Salt, containing from 28 to 32 per cent of sulphate of potassa, equal to from 15 to 17.3 per cent of potassium oxide	20–25	1.25
Kainit, low grade, containing 22 to 26 per cent of sulphate of potassa, equal to from 11.9 to 14 per cent of potassium oxide .	15–18	1
Sulphate of Magnesia (Kieserite), containing 55 per cent of that compound . .	14–15	0.8–1
Sulphate of Magnesia (Kieserite), containing from 60 to 70 per cent of that compound,	20–25	1–1.25
Fine-ground Gypsum, containing from 95 to 98 per cent of that compound . . .	9	0.5

I.

Potash-Salts.

I.

German Potash-Salt.

(H. L. Phelps, Northampton, Mass.)

	Per cent.
Moisture at 100–110° C.	4.81
Potassium oxide	37.33
Sodium oxide	4.93
Sulphuric acid	9.17
Magnesium oxide	5.77
Calcium oxide	None.
Insoluble matter	1.60

II.

German Potash-Salt.

(Quinnipiac Fertilizer Co., New Haven, Conn.; collected of Mr. Adams, Hadley Mass.)

	Per cent.
Moisture at 100° C.	1.36
Potassium oxide	50.40
Sodium oxide	1.30
Sulphuric acid	20.91
Magnesium oxide	Traces.
Calcium oxide	Traces.

III.

German Potash-Salt.

(D. A. Horton, Northampton, Mass.)

	Per cent.
Moisture at 100° C.	.45
Potassium oxide	43.60
Sodium oxide	6.24
Sulphuric acid	21.53
Magnesium oxide	Traces.
Calcium oxide	Traces.
Insoluble matter	.90

IV.

Muriate of Potash.

(Bowker Fertilizer Co., Boston, Mass.)

	Per cent.
Moisture at 100° C.	2.64
Potassium oxide	44.63
Sodium oxide	5.10
Sulphuric acid	.68
Calcium oxide	.77
Magnesium oxide	3.78
Chlorine	40.77

V.

Muriate of Potash.

(Messrs. L. B. Darling & Co.; collected of Messrs. J. & J. A. Rice, Worcester, Mass.)

	Per cent.
Moisture at 100° C.	7.60
Potassium oxide	49.94
Sodium oxide	3.85
Sulphuric acid	.34
Calcium oxide	3.46
Magnesium oxide	3.39
Insoluble matter	.80

VI.

Muriate of Potash.

(H. L. Phelps, Northampton, Mass.)

	Per cent.
Moisture at 100° C	7.60
Potassium chloride	81.82
Sodium chloride	16.36
Insoluble matter	.20

VII.

Muriate of Potash.

(D. A. Horton, Northampton, Mass.)

	Per cent.
Moisture at 100° C.	1.40
Potassium chloride	81.80
Sodium chloride	16.38
Insoluble matter	.42

Nos. I., II., III., of the above-stated samples, consist of a mixture of potassium chloride and potassium sulphate; IV. and V. are inferior grades of muriate of potash; VI. and VII. are fair representatives of the last-named article. Some of these salines contain a considerable admixture of magnesium chloride (IV., V.), and ought to be carefully used for reasons repeatedly stated in previous reports. The safest course consists in their early application, to allow the passage of the objectionable admixtures to the subsoil.

Crude Sulphate of Magnesia (Kieserite).

(F. J. Kinney, Worcester, Mass.)

	Per cent.
Moisture at 100° C.	26.22
Magnesium oxide	17.10
Sulphuric acid	39.54
Chlorine	2.07
Sand, &c.	2.17

This material, which contains also some soda compounds, sells at from fourteen dollars to fifteen dollars per ton. It may serve as a valuable absorbent of ammonia in stables and elsewhere.

Gypsum (Nova Scotia).

	I. Per cent.	II. Per cent.
Calcium oxide	32.60	32.77
Sulphuric acid	46.75	44.64
Insoluble matter	.85	3.50

No. I. was obtained from a Boston dealer, and No. II. was collected of Messrs. Arms & Co., Greenfield, Mass. Both are fair specimens of their kind.

Limekiln-Ashes.

(Sent from Amherst, Mass.)

	Per cent.
Moisture at 100° C.	.95
Calcium oxide	36.00
Magnesium oxide	4.45
Potassium oxide	.86
Phosphoric acid	Mere trace.
Insoluble matter	53.77

This material is worth much less than a common air-slaked lime, as it contains more than fifty per cent of insoluble, worthless matter.

Marl (Canada).

(This sample was sent on for examination from Lee, Mass.)

	Per cent.
Carbonate of lime	90.37
Carbonate of magnesia	1.29
Aluminium oxide and iron sesquichloride	1.00
Phosphoric acid	.07
Clay, &c.	3.07
Moisture, with a trace of organic matter	4.20

The name of marl is not correctly applied, for the analytical results refer more properly to a crumbled limestone.

Chili Saltpetre.

	Per cent.
Moisture at 100° C.	1.32
Insoluble matter	.90
Sodium chloride	.33
Sodium sulphate	.14
Sodium nitrate	97.31

The trade in Chili saltpetre (sodium nitrate) has been seriously disturbed during the past year in consequence of a war between the governments which are in possession of the extensive mines of nitrates in South America. The hostilities between Chili and Bolivia began towards the end of February with a blockade of the Bolivian ports — Mexilloñes, Caracotes, and Autofogasta — through which the products of the Chilian-nitrate mines find their way into the

general market. The cause of the war, it is stated, is the taxation of the nitrates of Chilian manufacture by the Bolivian Government, in violation of an existing commercial treaty between the contending parties, placing the Chilian product at a commercial disadvantage with the nitrates from the mines of Peru, the ally of Bolivia. The extent of the effect of these unfortunate conditions can be well approximated from the circumstance that the exportation of the Chilian sodium nitrate from the port of Autofagasta alone has been, of later years, not less than twelve thousand tons per month. As the stock on hand in our depots at the beginning of the war was known to be quite large, the market-price changed but gradually. Our spring supply of Chili saltpetre was obtained at former prices; i.e., from three cents and a half to four cents per pound: the latest New-York market quotations are, however, from four cents and seven-eighths to five cents and a quarter per pound. It is to be hoped that this valuable resource of nitrogen for agricultural purposes may soon be again within the reach of a remunerative farm practice.

Crude Sulphate of Ammonia.

(Quinnipiac Fertilizer Co., New Haven, Conn.; collected of D. A. Horton, Northampton, Mass.)

	Per cent.
Moisture at 100° C.	1.50
Ammonia	24.61
Sulphuric acid	60.80
Insoluble matter	Trace.

Our home-supply of ammonium sulphate seems to be increasing from year to year, showing an increased appreciation of the ammonial refuse liquors from gas-houses, and factories of animal charcoal and bone-black, for agricultural purposes.

I.

Ground Dried Flesh.

(Messrs. Bauch & Sons, Philadelphia, Penn.)

	Per cent.
Moisture at 100° C.	8.37
Organic and volatile matter	89.86
Ash constituents	10.14
Sand, &c.	.77
Phosphoric acid	3.58
Nitrogen	10.56
Fat	16.59

Valuation per ton of two thousand pounds: —

71.6 pounds of phosphoric acid	$4.29
211.2 pounds of nitrogen	42.24
	$46.53

II.

Ground Dried Flesh.

	Per cent.
Moisture at 100° C.	10.00
Nitrogen	11.50

Valuation per ton of two thousand pounds: —

230 pounds of nitrogen	$46.00

Substances like No. I. pay best as concentrated food for farm-stock: the large percentage of fat, and the high rate of digestibility of animal matter, like flesh, promise excellent results in a rational system of stock-feeding. The time is not very far off when many of our animal refuse substances will be better economized by feeding them to our live-stock before they serve as plant-food.

Bones.

I. — II.

Fine Bones.

(Messrs. L. B. Darling & Co., Pawtucket, R.I.; collected from Boston dealers.)

	I. Per cent.	II. Per cent.
Moisture at 100° C.	3.42	3.38
Organic and volatile matter	44.36	41.80
Ash constituents	55.64	58.20
Total nitrogen	4.32	4.48
Total phosphoric acid	23.37	23.80
Sand, &c.	.70	.13

III.

Fine Bones.

(Messrs. Belknap & Sons, Portland, Me.; collected of Messrs. J. & J. A. Rice, Worcester, Mass.)

	Per cent.
Moisture at 100° C.	9.09
Organic and volatile matter	46.70
Ash constituents	53.30
Total nitrogen	4.08
Total phosphoric acid	22.20
Sand, &c.	.06

IV.

Flour of Bones.

(Messrs. Rafferty & Williams, New York; collected of Messrs. Garland, Houghton, & Sears, Worcester, Mass.)

	Per cent.
Moisture at 100° C.	3.60
Organic and volatile matter	44.35
Ash constituents	55.60
Total nitrogen	3.44
Total phosphoric acid	22.80
Sand, &c.	.20

V.

Fine Bones.

(Messrs. H. B. Arnold & Co., Boston; collected of Messrs. Parker & Gannett, Boston, Mass.)

	Per cent.
Moisture at 100° C.	10.80
Organic and volatile matter	25.06
Ash constituents	74.94
Total nitrogen	1.62
Total phosphoric acid	27.37
Sand, &c.	.06

The above samples of ground bones represent the extremes, in the composition of that article, found in our markets: the amount of nitrogen differs from 1.62 per cent to 4.5 per cent, and that of the phosphoric acid from 22.1 per cent to 27.4 per cent. The same relation was noticed in regard to their mechanical condition. No. IV. was of an exceptionally fine condition, and No. III. was the coarsest in the lot. The finest ground article with the highest percentage of nitrogen is usually the most valuable kind of fine bones, provided the nitrogen noticed is due to the presence of a liberal amount of nitrogenous matter naturally distributed through the bones, and not to adhering flesh. 3.3 pounds of phosphoric acid are commercially considered equal to one pound of nitrogen.

Dissolved Bone-Black.

(Bowker Fertilizer Co., Boston, Mass.)

	Per cent.
Moisture at 100° C.	14.08
Soluble phosphoric acid	16.48

Valuation per ton of two thousand pounds: —

329.6 pounds of soluble phosphoric acid	$39 56

Fish Fertilizers.

I.

Dry Ground Fish.

(Prepared by L. Cornell's hot-air drying-machine.)

	Per cent.
Moisture at 100° C.	8.60
Organic and volatile matter	82.35
Ash constituents	17.63
Phosphoric acid	7.61
Nitrogen	8.71
Sand, &c.	1.02

Valuation per ton of two thousand pounds: —

152.2 pounds of phosphoric acid	$9 13
174.2 pounds of nitrogen	34 84
	$43 97

II.

Dry Ground Fish.

(Messrs. Bradley & Co., Boston, Mass.; collected of H. L. Phelps, Northampton, Mass.)

	Per cent.
Moisture at 100° C.	23.20
Organic and volatile matter	80.63
Ash constituents	19.37
Phosphoric acid	7.92
Nitrogen	7.41
Sand, &c.	.82

Valuation per ton of two thousand pounds: —

158.4 pounds of phosphoric acid	$9 51
148.2 pounds of nitrogen	29 64
	$39 15

III.

Dried Herring Scrap.

(Henry G. Hawes, Boston, Mass.)

	Per cent.
Moisture at 100° C.	13.78
Organic and volatile matter	84.01
Ash constituents	15.99
Phosphoric acid	4.33
Nitrogen	10.24

Valuation per ton of two thousand pounds: —

86.6 pounds of phosphoric acid	$5 20
204.8 pounds of nitrogen	40 96
	$46 16

IV.

Blackfish and Whale Fish Guano.

(Jonathan Cook, Cape-Cod Guano-Works, Provincetown, Mass.)

	Per cent.
Moisture at 100° C.	9.37
Organic and volatile matter	54.14
Ash constituents	45.86
Phosphoric acid	16.64
Nitrogen	4.74
Sand, &c.	3.32

Valuation per ton of two thousand pounds: —

332.8 pounds of phosphoric acid	$19 97
94.8 pounds of nitrogen	18 96
	$38 93

V.

Half-dry Fish.

(H. L. Phelps, Northampton, Mass.)

	Per cent.
Moisture at 100° C.	50.13
Organic and volatile matter	85.44
Ash constituents	14.56
Phosphoric acid	5 97
Nitrogen	4.40
Sand, &c.	1.67

Valuation per ton of two thousand pounds: —

119.4 pounds of phosphoric acid	$7 17
88.0 pounds of nitrogen	17 60
	$24 77

VI.

Fish and Kainit.

(Quinnipiac Fertilizer Co., New Haven, Conn., D. A. Horton, Agent, Northampton, Mass.)

	Per cent.
Moisture at 100° C.	28.26
Organic and volatile matter	68.04
Ash constituents	31.96
Phosphoric acid	5.22
Nitrogen	3.77
Potassium oxide	3.78

Valuation per ton of two thousand pounds: —

104.4 pounds of phosphoric acid	$6 39
75.4 pounds of nitrogen	15 08
75.6 pounds of potassium oxide	3 03
	$24 50

Halibut Fish-Refuse.

(Hon. J. J. H. Gregory, Marblehead, Mass.)

	Per cent.
Moisture at 100° C.	47.22
Organic and volatile matter	79.22
Ash constituents	20.78
Nitrogen	2.43
Phosphoric acid	8.56
Sand, &c.	1.82

Valuation per ton of two thousand pounds: —

171.2 pounds of phosphoric acid	$10 27
48.6 pounds of nitrogen	9 72
	$19 99

Fish-Liver Refuse.

(Hon. J. J. H. Gregory, Marblehead, Mass.)

	Per cent.
Moisture at 100° C.	50.58
Organic and volatile matter	98.08
Ash constituents	1.92
Nitrogen	4.35
Phosphoric acid	1.02
Sand, &c.	.16

Valuation per ton of two thousand pounds: —

87.0 pounds of nitrogen	$17 40
20.4 pounds of phosphoric acid	1 23
	$18 63

Our commercial fish-fertilizers, which were hitherto almost exclusively obtained from the Menhaden Fish-Rendering-Works, have of late received valuable accessions from other branches of our fish-industry, as may be noticed from the preceding analytical statements. It is quite desirable that a larger proportion of the animal-refuse matter from our cod-fisheries should be added to our home resources of efficient fertilizing materials.

Abstract from the Report of the United-States Menhaden Oil and Guano Association, Jan. 15, 1880.

Number of factories in operation in 1879	60
Number of factories in operation in 1878	56
Number of sailing-vessels employed in 1879	204
Number of sailing-vessels employed in 1878	279
Number of steamers employed in 1879	81
Number of steamers employed in 1878	64
Number of men employed in 1879	2,296
Number of men employed in 1878	3,337
Amount of capital invested in 1879	$2,502,500
Amount of capital invested in 1878	2,350,000
Number of fish caught in 1879	637,063,750
Number of fish caught in 1878	767,779,250
Number of barrels in 1879	2,123,546
Number of barrels in 1878	2,559,264
Number of gallons oil made in 1879	2,258,901
Number of gallons oil made in 1878	3,809,233
Number of tons crude guano made in 1879	67,059
Number of tons crude guano made in 1878	83,719
Number of tons guano dried in 1879	29,563
Number of tons guano dried in 1878	19,377
Number of gallons oil held by makers Jan. 15, 1879	52,894
Number of gallons oil held by makers Jan. 9, 1878	742,600
Number of tons guano held by makers Jan. 15, 1880	3,772
Number of tons guano held by makers Jan. 15, 1879	6,885
Yield of oil per thousand in 1879	4 gallons.

Bat-Guano.

(San Antonio, Tex.)

	Per cent.
Moisture at 100° C.	8.78
Organic and volatile matter	71.10
Ash constituents	28.90
Phosphoric acid	5.17
Nitrogen	8.26

	Per cent.
Potassium oxide	Trace.
Sand, &c.	11.40

Valuation per ton of two thousand pounds: —

103.4 pounds of phosphoric acid	$5 17
165.2 pounds of nitrogen	29 73
	$34 73

The composition of the bat-guanos, as may be noticed from the statements in previous reports, varies in an unusual degree. They are sold by analysis, and are mainly used with us as a nitrogenous material in the manufacture of fertilizers. A firm in New York advertises the following articles: —

(*a*) Bat-guano containing 8 per cent of nitrogen, and 7 per cent of phosphoric acid.

(*b*) Bat-guano containing 2.39 per cent of nitrogen, and 16 per cent of phosphoric acid.

(*c*) Bat-guano containing 5.49 per cent of nitrogen, and 9 per cent of phosphoric acid.

The latter samples evidently consist largely of the bones of bats.

Peruvian Guano, warranted No. 1.

(Messrs. Crafts, Whately, Mass.)

	Per cent.
Moisture at 100° C.	10.40
Organic and volatile matter	50.60
Ash constituents	49.40
Total nitrogen	9.32
Total phosphoric acid	13.14
Soluble phosphoric acid	6.26
Reverted phosphoric acid	2.21
Insoluble phosphoric acid	4.67
Potassium oxide	2.61
Sand, &c	11.91

Valuation per ton of two thousand pounds: —

186.4 pounds of nitrogen	$37 28
125.2 pounds of soluble phosphoric acid	15 02
44.2 pounds of reverted phosphoric acid	3 98
93.4 pounds of insoluble phosphoric acid	5 60
56.2 pounds of potassium oxide	2 25
	$64 13

Animal Fertilizer with Potash.

(Messrs. L. B. Darling & Co., Pawtucket, R.I.; sent by George W. Humphrey, Rochester, Mass.)

	Per cent.
Moisture at 100° C.	10.22
Soluble phosphoric acid	1.91
Reverted phosphoric acid	2.96
Insoluble phosphoric acid	6.76
Nitrogen	5.73
Potassium oxide	4.68
Sand, &c.	.09

Valuation per ton of two thousand pounds:—

38.2 pounds of soluble phosphoric acid	$4 59
59.2 pounds of reverted phosphoric acid	5 33
135.2 pounds of insoluble phosphoric acid	8 11
114 6 pounds of nitrogen	22 92
93.6 pounds of potassium oxide	3 75
	$44 70

Animal Guano.

(Messrs. Edwards & Thompson, Chicago, Ill.; collected of Henry Hubbard, Hatfield, Mass.)

	Per cent.
Moisture at 100° C.	11.37
Organic and volatile matter	53.73
Ash constituents	46.27
Phosphoric acid	9.69
Nitrogen	6.02

Valuation per ton of two thousand pounds:—

193.8 pounds of phosphoric acid	$11 62
120.4 pounds of nitrogen	24 08
	$35 70

Ammoniated Superphosphates.

I.

Bradley's XL Superphosphate.

(Bradley Fertilizer Co., Boston, Mass.; collected of Messrs. Bagg & Batchelder, Springfield, Mass.)

	Per cent.
Moisture at 100° C.	18.70
Organic and volatile matter	57.66
Ash constituents	42.34
Total nitrogen	3.58

	Per cent.
Total phosphoric acid	10.32
Soluble phosphoric	8.40
Reverted phosphoric acid	.70
Insoluble phosphoric acid	1.22
Potassium oxide	1.88
Insoluble matter	2.30

Valuation per ton of two thousand pounds:—

71.6 pounds of nitrogen	$14 32
168.0 pounds of soluble phosphoric acid	20 16
14.0 pounds of reverted phosphoric acid	1 26
24.4 pounds of insoluble phosphoric acid	1 46
37.6 pounds of potassium oxide	1 50
	$38 70

II.

Grass Fertilizer.

(Bradley Fertilizer Co., Boston, Mass.; collected of H. L. Phelps, Northampton, Mass.)

	Per cent.
Moisture at 100° C.	12.78
Total nitrogen	7.31
Potassium oxide	7.25
Total phosphoric acid	7.26
Soluble phosphoric acid	5.88
Reverted phosphoric acid	.59
Insoluble phosphoric acid	.79
Sand, &c.	3.74

Valuation per ton of two thousand pounds:—

146.2 pounds of nitrogen	$29 24
145.0 pounds of potassium oxide	5 80
117.6 pounds of soluble phosphoric acid	14 11
11.8 pounds of reverted phosphoric acid	1 06
15.8 pounds of insoluble phosphoric acid	95
	$51 16

III.

German Plant-Food.

(Charles W. Guy, Boston, Mass.)

	Per cent.
Moisture at 100° C.	5.50
Total nitrogen	3.13
Total phosphoric acid	11.10
Soluble phosphoric acid	7.39
Reverted phosphoric acid	3.11

	Per cent.
Insoluble phosphoric acid	.60
Potassium oxide	.24
Sand, &c.	3.60

Valuation per ton of two thousand pounds: —

62.6 pounds of nitrogen	$12 52
147.8 pounds of soluble phosphoric acid	17 74
62.2 pounds of reverted phosphoric acid	5 60
12.0 pounds of insoluble phosphoric acid	72
4.8 pounds of potassium oxide	19
	$36 77

IV.

Russel Coe's Ammoniated Superphosphate.

(Messrs. Whittemore Brothers, Boston, Mass.)

	Per cent.
Moisture at 100° C.	31.04
Organic and volatile matter	52.90
Ash constituents	47.10
Total phosphoric acid	14.13
Soluble phosphoric acid	9.19
Reverted phosphoric acid	.85
Insoluble phosphoric acid	4.09
Total nitrogen	3.40
Potassium oxide	Trace.
Sand, &c.	4.04

Valuation per ton of two thousand pounds: —

68.0 pounds of nitrogen	$13 60
183 8 pounds of soluble phosphoric acid	22 06
17.0 pounds of reverted phosphoric acid	1 53
81.8 pounds of insoluble phosphoric acid	4 91
	$42 10

V.

The "Americus Brand" of Ammoniated Bone Superphosphate.

(Messrs. Rafferty & Williams, New York; collected of Messrs. Garland, Houghton, & Sears, Worcester, Mass.)

	Per cent.
Moisture at 100° C.	14.70
Total phosphoric acid	12.24
Soluble phosphoric acid	9.21
Reverted phosphoric acid	1.50
Insoluble phosphoric acid	1.53
Nitrogen	2.67
Potassium oxide	2.43
Insoluble matter	3.08

Valuation per ton of two thousand pounds:—

53.4 pounds of nitrogen	$10 68
184.2 pounds of soluble phosphoric acid	22 10
30.0 pounds of reverted phosphoric acid	2 70
30.6 pounds of insoluble phosphoric acid	1 84
48.6 pounds of potassium oxide	1 95
	$39 27

VI.

Concord Chemical Fertilizer.

(Messrs. Marshall, Miles, & Co., Concord, Mass.)

	Per cent.
Moisture at 100° C.	23.00
Total phosphoric acid	3.73
Soluble phosphoric acid	Trace.
Nitrogen	3.22
Potassium oxide	1.33
Insoluble matter	5.74

Valuation per ton of two thousand pounds:—

74.6 pounds of phosphoric acid	$4 48
64.4 pounds of nitrogen	12 88
26.6 pounds of potassium oxide	1 07
	$18 43

VII.

Frank Coe's Ammoniated Superphosphate.

(J. A. Clark & Co., Worcester, Mass.)

	Per cent.
Moisture at 100° C.	16.02
Organic and volatile matter	77.46
Ash constituents	22.54
Total phosphoric acid	10.33
Soluble phosphoric acid	9.59
Insoluble phosphoric acid	.63
Nitrogen	2.31
Insoluble matter	1.10

Valuation per ton of two thousand pounds:—

191.8 pounds of soluble phosphoric acid	$23 01
12.6 pounds of insoluble phosphoric acid	76
46.2 pounds of nitrogen	9 24
	$33 01

VIII.

Bowker's Hill and Drill Phosphate.

(Bowker Fertilizer Co., Boston, Mass.; collected of H. C. Comins, Northampton, Mass.)

	Per cent.
Moisture at 100° C.	19.01
Organic and volatile matter	64.40
Ash constituents	35.60
Total phosphoric acid	12.84
Soluble phosphoric acid	10.34
Reverted phosphoric acid	.97
Insoluble phosphoric acid	1.53
Nitrogen	3.51

Valuation per ton of two thousand pounds: —

206.8 pounds of soluble phosphoric acid	$24 82
19.4 pounds of reverted phosphoric acid	1 75
30.6 pounds of insoluble phosphoric acid	1 84
70.2 pounds of nitrogen	14 04
	$42 45

IX.

"Bay State" Bone Superphosphate of Lime.

(J. A. Tucker, Boston, Mass.; collected of Messrs. J. A. Clark & Son, Worcester, Mass.)

	Per cent.
Moisture at 100° C.	21.20
Total phosphoric acid	11.30
Soluble phosphoric acid	9.20
Reverted phosphoric acid	1.89
Insoluble phosphoric acid	.21
Potassium oxide	.62
Nitrogen	2.53

Valuation per ton of two thousand pounds: —

184.0 pounds of soluble phosphoric acid	$22 08
37.8 pounds of reverted phosphoric acid	3 40
4.2 pounds of insoluble phosphoric acid	26
12.4 pounds of potassium oxide	4 96
50.6 pounds of nitrogen	10 12
	$40 82

X.

Stockbridge Manures; Forage Crops.

(**Bowker Fertilizer Co.**, Boston, Mass.; collected of Messrs. J. and J. A. Rice, Worcester, Mass.)

	Per cent.
Moisture at 100° C	16.72
Total phosphoric acid	4.62
Soluble phosphoric acid	3.83
Reverted phosphoric acid	.48
Insoluble phosphoric acid	.31
Nitrogen	3.64
Potassium oxide	10.14
Sand, &c.	1.02

Valuation per ton of two thousand pounds:—

76.6 pounds of soluble phosphoric acid	$9 19
5.6 pounds of reverted phosphoric acid	51
6.2 pounds of insoluble phosphoric acid	37
72.8 pounds of nitrogen	14 56
202.8 pounds of potassium oxide	8 12
	$32 75

XI.

Earle's Phosphate; Guano Manure.

(**Providence, R.I.**; sent by Joseph K. Baker, Esq., Dennisport, Mass.)

	Per cent.
Moisture at 100° C	14.56
Organic and volatile matter	58.05
Ash constituents	41.95
Total phosphoric acid	12.40
Soluble phosphoric acid	5.24
Reverted phosphoric acid	4.76
Insoluble phosphoric acid	2.40
Nitrogen	3.86
Potassium oxide	.20
Sand, &c.	3.00

Valuation per ton of two thousand pounds:—

104.8 pounds of soluble phosphoric acid	$12 58
95.2 pounds of reverted phosphoric acid	8 57
48.0 pounds of insoluble phosphoric acid	2 88
77.2 pounds of nitrogen	15 44
4.0 pounds of potassium oxide	16
	$39 63

XII.

Bowker's Lawn-Dressing.

(Bowker Fertilizer Co., Boston, Mass.; collected of H. C. Comins, Northampton, Mass.)

	Per cent.
Moisture at 100° C.	6.30
Organic and volatile matter	70.75
Ash constituents	29.25
Soluble phosphoric acid	5.62
Insoluble phosphoric acid	.44
Nitrogen	5.66
Potassium oxide	5.57
Sand, &c.	.25

Valuation per ton of two thousand pounds:—

112.4 pounds of soluble phosphoric acid	$13 49
8.8 pounds of insoluble phosphoric acid	53
113.2 pounds of nitrogen	27 17
111.4 pounds of potassium oxide	4 46
	$45 65

XIII.

Mitchells' Dissolved Bone Superphosphate.

(Providence, R.I.; collected of Messrs. J. & J. A. Rice, Worcester, Mass.)

	Per cent.
Moisture at 100° C.	20.99
Organic and volatile matter	58.24
Ash constituents	41.76
Nitrogen	1.52
Soluble phosphoric acid	6.42
Reverted phosphoric acid	1.16
Insoluble phosphoric acid	1.02
Insoluble matter, sand, &c.	6.08

Valuation per ton of two thousand pounds:—

30.4 pounds of nitrogen	$6 08
128.4 pounds of soluble phosphoric acid	15 41
23.2 pounds of reverted phosphoric acid	2 09
20.4 pounds of insoluble phosphoric acid	1 23
	$21 82

XIV.

Bosworth Brothers' Ammoniated Superphosphate.

(Putnam, Conn.; collected of Messrs. Wilson & Holden, Worcester, Mass.)

	Per cent.
Moisture at 100° C.	4.90
Organic and volatile matter	32.14
Ash constituents	67.86
Soluble phosphoric acid	5.11
Reverted phosphoric acid	5.85
Insoluble phosphoric acid	3.93
Nitrogen	2.37
Insoluble matter, sand, &c.	8.26

Valuation per ton of two thousand pounds: —

102.2 pounds of soluble phosphoric acid	$12 27
117.0 pounds of reverted phosphoric acid	10 53
78.6 pounds of insoluble phosphoric acid	2 72
47.4 pounds of nitrogen	9 48
	$35 00

XV.

Manhattan Blood-Guano.

(Charles Russell, Sunderland, Mass.)

	Per cent
Moisture at 100° C.	14.48
Organic and volatile matter	53.28
Ash constituents	46.72
Soluble phosphoric acid	7.16
Reverted phosphoric acid	1.01
Insoluble phosphoric acid	4.66
Nitrogen	2.98
Potassium oxide	.61
Insoluble matter	3.88

Valuation per ton of two thousand pounds: —

143.2 pounds of soluble phosphoric acid	$17 18
20.2 pounds of reverted phosphoric acid	1 82
93.2 pounds of insoluble phosphoric acid	5 59
59.6 pounds of nitrogen	11 92
12.2 pounds of potassium oxide	49
	$37 00

XVI.

William Bradley's Patent Superphosphate.

(Messrs. Parker & Gannett, Boston, Mass.)

	Per cent.
Moisture at 100° C.	3.86
Organic and volatile matter	44.00
Ash constituents	56.00
Soluble phosphoric acid	7.77
Insoluble phosphoric acid	5.68
Nitrogen	3 88
Insoluble matter	6.58

Valuation per ton of two thousand pounds:—

155.4 pounds of soluble phosphoric acid	$18 65
113.6 pounds of insoluble phosphoric acid	6 82
77.6 pounds of nitrogen	15 52
	$40 99

XVII.

William Bradley's Sea-Fowl Guano.

(Albert Montague, Esq., Sunderland, Mass)

	Per cent.
Moisture at 100° C.	11.80
Organic and volatile matter	55.90
Ash constituents	44.10
Soluble phosphoric acid	8.56
Insoluble phosphoric acid	3.32
Nitrogen	3.74
Potassium oxide	1.70
Insoluble matter	5.02

Valuation per ton of two thousand pounds:—

171.2 pounds of soluble phosphoric acid	$20 58
66.4 pounds of insoluble phosphoric acid	3 99
74.8 pounds of nitrogen	14 96
34.0 pounds of potassium oxide	1 36
	$40 89

XVII.

Stockbridge Manures; Potato.

(H. C. Comins, Northampton, Mass.)

	Per cent.
Moisture at 100° C.	14.30
Organic and volatile matter	62.46
Ash constituents	37.54

	Per cent.
Soluble phosphoric acid	5.74
Reverted phosphoric acid	.08
Insoluble phosphoric acid	.44
Nitrogen	4.14
Potassium oxide	7.00
Insoluble matter	1.36

Valuation per ton of two thousand pounds:—

114.8 pounds of soluble phosphoric acid	$13 78
1.6 pounds of reverted phosphoric acid	14
8.8 pounds of insoluble phosphoric acid	53
82.8 pounds of nitrogen	16 56
140.0 pounds of potassium oxide	5 60
	$36 61

XIX.

Soluble Pacific Guano.

(Pacific Guano Co., Boston, Mass.)

	Per cent.
Moisture at 100° C.	14.40
Organic and volaitle matter	58.64
Ash constituents	41.36
Soluble phosphoric acid	7.93
Reverted phosphoric acid	.95
Insoluble phosphoric acid	1.40
Nitrogen	2.50
Potassium oxide	2.12
Insoluble matter	4.50

Valuation per ton of two thousand pounds:—

158.6 pounds of soluble phosphoric acid	$19 03
19.0 pounds of reverted phosphoric acid	1 71
28.0 pounds of insoluble phosphoric acid	1 68
50.0 pounds of nitrogen	10 00
42.4 pounds of potassium oxide	1 70
	$34 12

XX.

Matfield Turnip-Fertilizer.

	Per cent.
Moisture at 100° C.	11.40
Organic and volatile matter	55.96
Ash constituents	44.04
Total phosphoric acid	3.82
Soluble phosphoric acid	1.27

	Per cent.
Reverted phosphoric acid	1.60
Insoluble phosphoric acid	.95
Nitrogen	3.40
Potassium oxide	8.20

Valuation per ton of two thousand pounds: —

25.4 pounds of soluble phosphoric acid	$3 05
32.0 pounds of reverted phosphoric acid	2 88
19.0 pounds of insoluble phosphoric acid	1 14
68.0 pounds of nitrogen	16 32
164.0 pounds of potassium oxide	6 56
	$29 95

XXI.

Matfield Corn-Fertilizer.

	Per cent.
Moisture at 100° C.	10.55
Total phosphoric acid	3.63
Soluble phosphoric acid	1.98
Reverted phosphoric acid	1.16
Insoluble phosphoric acid	.49
Potassium oxide	5.60
Nitrogen	5.45
Insoluble matter, sand, &c.	5.63

Valuation per ton of two thousand pounds: —

39.6 pounds of soluble phosphoric acid	$4 75
23.2 pounds of reverted phosphoric acid	2 08
9.8 pounds of insoluble phosphoric acid	59
112.0 pounds of potassium oxide	4 48
109.0 pounds of nitrogen	26 16
	$38 06

XXII.

Bowker's Ammoniated Food for Flowers.

(Bowker Fertilizer Co.)

	Per cent.
Moisture at 100° C.	6.68
Organic and volatile matter	51.30
Ash constituents	48.70
Soluble phosphoric acid	10.23
Reverted phosphoric acid	.48
Insoluble phosphoric acid	1.08
Nitrogen	4.80
Potassium oxide	2.68
Insoluble matter	.80

Valuation per ton of two thousand pounds: —

204.6 pounds of soluble phosphoric acid	$24 55
9.6 pounds of reverted phosphoric acid	87
21.6 pounds of insoluble phosphoric acid	1 30
96.0 pounds of nitrogen	23 04
53.6 pounds of potassium oxide	2 15
	$51 91

XXIII.

Bradley's XL. Superphosphate.

(Bradley Fertilizer Co., Boston, Mass.; collected of Albert Montague, Esq., Sunderland, Mass.)

	Per cent.
Moisture at 100° C.	17.34
Organic and volatile matter	59.90
Ash constituents	40.10
Soluble phosphoric acid	8.59
Reverted phosphoric acid	.15
Insoluble phosphoric acid	1.34
Nitrogen	3.25
Potassium oxide	1.29
Insoluble matter	.34

Valuation per ton of two thousand pounds: —

171.8 pounds of soluble phosphoric acid	$20 61
3 0 pounds of reverted phosphoric acid	27
26.8 pounds of insoluble phosphoric acid	1 61
65.0 pounds of nitrogen	13 00
25.8 pounds of potassium oxide	1 04
	$36 53

XXIV.

Soluble Ammoniated Superphosphate.

(Quinnipiac Fertilizer Co., New Haven, Conn.; collected of D. A. Horton, Northampton, Mass.)

	Per cent.
Moisture at 100° C.	22.96
Organic and volatile matter	64.60
Ash constituents	35.40
Soluble phosphoric acid	5.10
Reverted phosphoric acid	2.70
Insoluble phosphoric acid	1.50
Nitrogen	3.58
Potassium oxide	2.34

Valuation per ton of two thousand pounds: —

102.0 pounds of soluble phosphoric acid	$12 24
54.0 pounds of reverted phosphoric acid	4 86
30.0 pounds of insoluble phosphoric acid	1 80
71.6 pounds of nitrogen	14 32
46.8 pounds of potassium oxide	1 88
	$35 10

XXV.

International Fertilizer.

(A. M. Goding, Stow, Mass.; collected of Charles Brown, Stow, Mass.)

	Per cent.
Moisture at 100° C.	19.14
Organic and volatile matter	41.75
Ash constituents	58.25
Nitrogen	1.90
Potassium oxide	5.22
Soluble phosphoric acid	.31
Reverted phosphoric acid	2.30
Insoluble phosphoric acid	1.32
Insoluble matter, sand, &c.	20.70

Valuation per ton of two thousand pounds: —

38.0 pounds of nitrogen	$7 60
104.4 pounds of potassium oxide	4 18
6.2 pounds of soluble phosphoric acid	75
46.0 pounds of reverted phosphoric acid	4 14
26.4 pounds of insoluble phosphoric acid	1 59
	$18 26

XXVI.

International Fertilizer.

(A. M. Goding, Stow, Mass.; collected of W. F. Sawyer, Harvard, Mass.)

	Per cent.
Moisture at 100° C.	4.00
Organic and volatile matter	35.02
Ash constituents	64.98
Nitrogen	2.57
Potassium oxide	7.92
Soluble phosphoric acid	.25
Reverted phosphoric acid	1.77
Insoluble phosphoric acid	1.80
Insoluble matter, sand, &c.	21.52

Valuation per ton of two thousand pounds: —

51.4 pounds of nitrogen	$10 28
158.4 pounds of potassium oxide	6 34
5.0 pounds of soluble phosphoric acid . .	60
35.5 pounds of reverted phosphoric acid . .	3 20
36.2 pounds of insoluble phosphoric acid . .	2 18
	$22 60

XXVII.

International Fertilizer.

(A. M. Goding, Stow, Mass.; collected of G. W. Barnard, Berlin, Mass.)

	Per cent.
Moisture at 100° C.	26.77
Organic and volatile matter	46.67
Ash constituents	53.33
Nitrogen	1.82
Potassium oxide	5.47
Soluble phosphoric acid	.25
Reverted phosphoric acid	.95
Insoluble phosphoric acid	1.19
Insoluble matter, sand, &c.	19.36

Valuation per ton of two thousand pounds: —

36.4 pounds of nitrogen	$7 28
109.4 pounds of potassium oxide	4 37
5 0 pounds of soluble phosphoric acid . . .	60
19.0 pounds of reverted phosphoric acid . .	1 71
23.8 pounds of insoluble phosphoric acid . .	1 43
	$15 39

Samples Nos. XXV., XXVI., and XXVII., were interior in mechanical condition and in chemical composition: the fertilizer was evidently manufactured by an inexperienced party. Farmers do well to ascertain, before buying, whether the person who offers a new brand of fertilizer for sale is qualified to produce a good article at reasonable rates, and whether he complies with the regulations of our laws for the sale of fertilizers. Parties who do not comply with the *first* obligation — to report to the proper authorities the introduction of a new fertilizer into our market, and to state its essential constituents as prescribed by our laws — assume an exceptional position in their trade, and offer but little guaranty for responsible sales. An efficient protection

against losses, which the State by special laws designs to secure to the farming community, depends largely upon the interest which dealers and farmers will take in their enforcement.

Glue-Refuse Material.

(Sent on for Examination.)

Yellowish-green, pasty, acid mass.

	Per cent.
Moisture at 100° C.	22.33
Organic and volatile matter	53.28
Ash constituents	46.72
Soluble phosphoric acid	12.28
Insoluble phosphoric acid	2.54
Nitrogen	1.64
Calcium oxide (lime)	21.28
Sand, &c.	.13

Valuation per ton of two thousand pounds: —

245.6 pounds of soluble phosphoric acid	$29 47
50.8 pounds of insouble phosphoric acid	3 05
32.8 pounds of nitrogen	4 92
	$37 44

Compost from Soap-Factory.

One thousand parts contained the following constituents: —

	Per cent.
Moisture at 100° C.	218.00
Organic and volatile matter	263.20
Ash constituents	736.80
Nitrogen	2.60
Phosphoric acid	1.46
Potassium oxide	.99
Sodium oxide	10.30
Calcium oxide	4.50
Magnesium oxide	.50
Sulphuric acid	1.80
Sand, earth, &c.	

Poudrette (Deodorized Night-Soil).

(Sent on for Examination.)

	Per cent.
Moisture at 100° C.	5.25
Organic and volatile matter	64.55
Ash constituents	35.45
Phosphoric acid	5.74

	Per cent.
Nitrogen (ammonia .01)	3.58
Potassium oxide	.49
Sand, &c.	4.65

Valuation per ton of two thousand pounds: —

114.8 pounds of phosphoric acid	$6 88
71.6 pounds of nitrogen	10 65
9.8 pounds of potassium oxide	40
	$17 93

Turfy Peat.

(Auburn, Worcester Co., Mass.)

	Per cent.
Moisture at 100° C.	85.34
Vegetable matter left	14.66
Ash constituents	1.20
Calcium oxide (lime) in ash	.50
Nitrogen (vegetable matter)	.49

One hundred parts of the original wet peat left twenty-two parts of air-dry matter. The sample represents a good quality of its kind. Farmers who apply a well-prepared peat to their soil ought to keep in mind that they add, as a rule, only a small amount of slow-acting nitrogen to their soil resources of plant-food. The frequent good results in consequence of a judicious application of peat as a fertilizing material is mainly due, either to an improvement of the physical condition of the soil (rendering a light sandy soil more retentive, and, in case of a coarse fibrous peat, a heavy soil more permeable), or to the favorable re-action of the products of a decomposing organic matter on the latent resources of the soil on mineral plant-food. The larger the crops which have been gathered, the stronger must be the subsequent manuring, is a rule which applies with particular force to those instances where the mere use of peat has increased the yield of the lands under cultivation.

Rockweed.

The examination of this sea-plant was carried on at the request of Hon. James J. H. Gregory of Marblehead, Mass., for the purpose of testing the relative fertilizing value of specimens collected in different seasons. One lot of the rockweed was collected in the middle of the month of May,

when the pods were well filled with a gelatinous matter; and the other one in the month of December, when this substance is not present. The samples arrived by express, well packed, in a fresh state.

I.

Rockweed collected in May, 1879.

	Per cent.
Fresh wet rockweed lost, in the air, of water	78.700
Fresh wet rockweed lost, at 100° C., of water	90.400
Air-dried rockweed consisted, of vegetable matter	88.220
Air-dried rockweed consisted, of water	11.780
The filled pods left, at 100° C., of solid organic matter	7.360
The fresh stems left, at 100° C., of solid organic matter	30.650
The slime of the pods dried at 100° C. contained, of nitrogen	2.920
Rockweed (entire plant with filled pods) dried at 100° C. contained, of nitrogen	2.286
Rockweed air-dried contained, of nitrogen	2.017
Rockweed, fresh (wet), contained, of nitrogen	.487
Rockweed dried at 100° C. contained, of ashes	28.930
Rockweed, air-dried, contained, of ashes	6.220
Rockweed, fresh (wet), contained, of ashes	3.770
The slime of the pods of the rockweed contained, of ashes	49.356

One hundred parts of the ash contained: —

	Per cent.
Potassium oxide	4.842
Sodium oxide	12.050
Calcium oxide	2.691
Magnesium oxide	2.753
Ferric oxide	.338
Sulphuric acid	7.986
Phosphoric acid	6.240

The quantities of some of the principal constituents of the ash are largely due to the sea-water, and the little shells which adhered to the plant when calcined.

II.

Rockweed collected in December, 1879.

	Per cent.
Fresh wet rockweed lost, in the air, of water	65.92
Fresh wet rockweed lost, at 100° C., of water	76.92

	Per cent.
Fresh wet rockweed contained, of vegetable matter,	23.08
Air-dried rockweed contained, of vegetable matter,	89.00
Air-dried rockweed contained, of water . .	11.00
Rockweed (entire plant) dried, at 100° C. contained, of nitrogen	1.721
Rockweed, air-dried, contained, of nitrogen . .	1.432
Rockweed, fresh (wet), contained, of nitrogen .	.397
Rockweed dried, at 100° C. contained, of ashes .	24.890
Rockweed, air-dried, contained, of ashes . .	22.150
Rockweed, fresh (wet), contained, of ashes . .	5.825

The composition of the ashes does not differ materially from that of the first sample.

A comparison of the above analytical results of both samples tends to show that the expense for labor controls to a large degree the decision regarding the best time to collect this sea-manure.

Mussel Mud.

This material was sent on for an analysis by Hon. James J. H. Gregory of Marblehead, Mass. The material consisted of a grayish-black mud containing fragments of shells, which occurs in shallow flats, along the seashore, beneath a deposit of live mussels.

	Per cent.
The mud dried at 100° C. lost, of water . .	60.010
The wet mud contained, of nitrogen . . .	.212
The original material lost by calcination, of its original weight	72.710

One hundred parts of the mud contained, soluble in hydrochloric acid, the following elements: —

	Per cent.
Potassium oxide	.1900
Sodium oxide	.6990
Calcium oxide	.9320
Magnesium oxide	.1380
Ferric oxide	3.4830
Sulphuric acid	.4246
Phosphoric acid	.0970

This material consists, in the main, of a clayey silt, containing small fragments of hornblende, quartz, mica, &c.; and it differs from other deposits along the seashore by an

admixture of some carbonate of lime in the form of shells. Its dark color is due to the presence of from eight to ten per cent of partially decayed organic matter.

CHARLES A. GOESSMANN,
State Inspector of Fertilizers.

AMHERST, MASS., Feb. 2, 1880.

APPENDIX.

COMPOSITION OF SOME COMPOUNDS IN FERTILIZERS.

One hundred parts of: —

Nitric acid contain 26 parts of nitrogen.

Ammonia contain 82.35 part of nitrogen.

Pure nitrate of potassa (saltpetre) contain 53.4 parts of nitric acid and 46.6 parts of potassium oxide.

Pure nitrate of soda (Chili saltpetre) contain 63.25 parts of nitric acid.

Chloride of potassium contain 52.4 parts of potassium, 63.1 parts of potassium oxide, and 47.6 parts of chlorine.

Pure sulphate of potassa contain 54.9 parts of potassium oxide and 46 parts of sulphuric acid.

Bone phosphate (tricalcic phosphate) contain 46 parts of phosphoric acid and 54 parts of calcium oxide (lime).

Calcined gypsum contain 41 parts of calcium oxide (lime) and 59 parts of sulphuric acid.

Uncalcined pure gypsum contain 32.5 parts of calcium oxide (lime), 46.5 parts of sulphuric acid, and 21 parts of water.

Carbonate of lime contain 56 parts of calcium oxide (lime) and 44 parts of carbonic acid.

Sulphate of magnesia (free of water) contain 33.3 per cent of magnesium oxide (magnesia) and 66.6 per cent of sulphuric acid.

C. A. G.

The Report was accepted.

Mr. GRINNELL then submitted the following

REPORT ON FARMERS' INSTITUTES IN FRANKLIN COUNTY.

On the fourth day of January, 1879, the Franklin-county Agricultural Society resolved itself into the Franklin Farmers' Institute, with the same officers, and appointed the first meeting for Jan. 21.

On that day over fifty farmers assembled in the grand-

jury room; and the subject of *dairying* was opened by a paper on that subject by Mr. BARBER of Bernardston. An active debate then followed, in which were discussed the different breeds of dairy cows, mode of keeping, and general treatment.

The merits of deep or shallow setting were also talked over, and the "Cooley system" explained.

The Institute then adjourned to Feb. 3, when it again met; and the question of "The Economy of Farm Machinery" was opened by a very suggestive paper by Mr. R. N. OAKMAN of Montague, favoring more employment of hand labor. His assertion, that, on a small farm, haying could be more economically done by hand labor than by the use of machinery, provoked a very lively discussion. The uses and advantages of machines generally, and of the different machines in use, were earnestly canvassed. The Institute then adjourned for a fortnight. Feb. 17 about seventy-five members attended, the subject being *dairying*. A very acceptable paper was read by Mr. JOHN M. SMITH of Sunderland, on "The Products of Neat-Cattle."

An extended discussion followed, illustrated by various experiences of old butter-makers.

The Cooley Creamery was shown; and milk in a can sixteen inches high, set six hours in ice-water, showed five inches of cream to have risen in that time.

The meeting was animated and satisfactory; but the time was felt to be too short for the subject, and the Institute adjourned for a fortnight to have a fuller discussion on all matters connected with the *dairy*. The Institute met Feb. 28, with over two hundred present, and was opened by an address from Major ALVORD of Easthampton, on "Dairy Produce," replete with information and suggestions. An earnest discussion followed on the manufacture of butter, use of various dairy implements, and the keeping and feeding of milch cows. A large number of dairy implements and appliances were shown, for the instruction of those farmers who had never seen them, and for strengthening the faith of those who had. Prominent were the Cabinet Creamery and a Pyramidal Metallic Strainer, by Mosely & Stoddart of Poultney, Vt.; the Cooley Creamery, Davis's Oscillating Churn, and Eureka Butter-Worker, by the Vermont Valley

Farm Machine Company of Bellows Falls; the Monitor Churn and Perfect Milk-pail, by the New-York Dairy Supply Company of New York; the Bullard, Victor, Blanchard, and Elmer Churns; and several other implements, as workers, presses, packages, &c. Higgins's Eureka Salt was also shown and given away by Thurber & Company of New York.

The essay, the discussion, and display of implements, were all exceedingly interesting and instructive, and induced much thought and subsequent action among the dairymen.

After appointing a committee to induce the Fitchburg Railroad to run a refrigerator car from Franklin County to Boston, the Institute adjourned. March 24 it again met, with an attendance of over sixty, to hear, first a pleasant paper from Col. R. H. LEAVITT of Charlemont, on "Farming Past and Present," comparing for a half-century the products of the county, the modes of harvesting and preparing them for sale or use, and the modes of marketing. The question discussed at the first meeting, of "*the comparative economy of machine or manual labor on small farms*," was then brought forward, and thoroughly talked up, and served to bring out facts and opinions on the cost, use, and care of various farm implements and machines.

It was voted, that, as a basis for the next year's meetings, the president should ask various farmers to keep account of the cost of producing various crops, as beef, pork, mutton, early lambs, and butter, and the value of skimmed milk as feed for calves or pigs.

The Institute then adjourned to meet the next winter, subject to a call from the president.

This Institute has been eminently successful, having held five meetings, with an average of seventy members at each, and without any assistance from speakers outside the Institute; the subject of dairying, including the breeds, feeding and treatment of milch cows, being the leading subject, as most interesting in a county which annually makes a million and a half pounds of butter.

The talk has been lively, filled with personal experiences, free (among a set of intelligent working-men all familiar with each other, and with the farms and modes of farming of each), with no acrimony, and restrained only by self

imposed limits of orderly debate. The interest was maintained fully to the last; and the feeling was unanimous that all had derived, not only much pleasure from this free interchange of thoughts and experiences, but also material benefit, and that more general good had resulted to the farming interest than comes from cattle-shows, which have become a mere scramble for petty premiums.

JAMES S. GRINNELL,
President Franklin Farmers' Institute.

The representative of each society was then called upon to make a statement in regard to the institutes held by his society, in accordance with the requirement of the Board at its last annual meeting, when it appeared that every society in the State had held at least three institutes, while several had greatly exceeded the required number, having found them very popular, instructive, and useful. The number thus held in the State during the past year exceeded a hundred. They were generally very largely attended; the exercises consisting of lectures, papers on special subjects, questions and answers, and discussions in which all present were invited to participate.

Mr. TAFT offered the following preamble and vote, which were unanimously adopted: —

Whereas The Board of Agriculture have seen in the public prints a charge that cattle infected by some contagious disease had been sold from the Agricultural College Farm; and

Whereas, From the best information at present in possession of the Board, this statement is believed to be utterly false; and

Whereas It is important to furnish an authoritative answer which shall satisfy the farmers of the State, and relieve any anxiety which they may feel: it is

Voted, That the attention of the Commissioners on Contagious Diseases among Cattle be called to this subject, and that they be requested immediately to examine the cattle at the Agricultural College, and all others claimed or suspected to be diseased, and to report as soon as may be the results of their investigations to this Board.

Professor GOESSMANN submitted a paper upon the chemistry of fruit-culture, prepared by himself and Professor S. T. Maynard, including a statement of experiments made at the Massachusetts Agricultural College at Amherst, as follows: —

CONTRIBUTIONS TO THE CHEMISTRY OF FRUIT-CULTURE.

BY PROFESSORS C. A. GOESSMANN AND S. T. MAYNARD OF THE MASSACHUSETTS AGRICULTURAL COLLEGE.

Whether a systematic and rational manuring of our fruit-bearing plants is essential to the continued production of good crops is a question worthy of careful attention. It seems reasonable to assume that the practice which has been recognized as indispensable to success in general agriculture ought to apply with equal force to operations in fruit-culture and horticulture in general.

Rational modern agriculture bases its claim of superior progress, as compared with that of former times, on the recognition and the application of the principle that it is essential for its continued success to return to the soil those substances which the crops take out of it. It has been one of the principal aims of numerous scientific investigators of agricultural problems during the past thirty years to prove the existence of these relations, and to study how to comply with their requirements in an economical manner. Most of our common farm-crops have received an undivided and careful attention from the beginning; their composition has been ascertained, and their action on the soil thereby established. In many instances their peculiar growth has been studied to learn in what form the various manures are best applied on different kinds of soil.

No one familiar with the results of recent investigations can fail to notice their extraordinary influence on the progress and improvement of farm practice. The same claim cannot be made with reference to fruit-culture and horticulture. Experiment-stations for the benefit of these branches of agriculture are but few, and these, in a majority of instances, are of very recent date. Superior skill and intelligence have been devoted to the promotion of their interests from an exclusively botanical stand-point; while

the peculiar intricacy of the subject, the growing of plants with a view to producing crops with an eye to quantity rather than to quality, may account, in part, for the little practical interest which most horticulturists have hitherto manifested in looking to chemistry as an assistant to their industry.

There is no want of valuable observations, in exceptional cases, of good success in producing fruits by the aid of various kinds of fertilizers; yet it is well recognized that but little satisfactory explanation can be given as to the particular relations which exist between the composition or the quality of fruit and certain constituents and conditions of the fertilizers used. The chemical composition of most fruits is but imperfectly known. The question, whether the ash-constituents of fruit bear any thing more than a mere incidental relation to the quality is still in doubt; and it derives its main support from the fact that the ash-constituents of a few of our cultivated fruits — the strawberry, for instance — have been found to differ widely both in quantity and quality from those of the wild plants from which they originated. No important inferences have as yet been drawn from these observations.

Numerous careful inquiries into the composition of many of our farm-crops have shown that the total amount of mineral or ash constituents of one and the same variety of plants may vary widely in different individual specimens when raised upon different soils, or under otherwise varying conditions of cultivation.

Experimental observation has thus far failed to prove the existence of any definite numerical relation between the total quantity of essential mineral or ash constituents and the entire dry organic matter of plants. We have learned that but few mineral elements are essential to the complete development of plants; yet we have only vague notions regarding their peculiar mode of action in the process of vegetable growth. Still, though ignorant of the peculiar mode in which these mineral constituents assist in the formation of organic matter, we have noticed in some of our most important farm-crops that a more or less liberal supply of certain essential articles of plant-food — as potash, nitrogen, &c. — frequently exerts a remarkable influence on the

general character and quality of crops so far as the relative proportions of some of their proximate organic constituents, as albuminoids, starch, or sugar, are concerned. Even the peculiar form in which potash, &c., has been applied, is known to exert a decided influence on the production of one or more organic constituents of plants. Judging from our past experience in general farm-management, it seems proper to assume that much benefit may accrue to fruit-culture and horticulture generally by studying the relations which exist between the composition of the soil and the ash-constituents of the fruits grown upon it. A rational system of manuring our fruit-bearing plants requires that kind of information for its foundation. It is quite certain that the practice of restoring to the soil, in suitable form and in due time, those constituents which the fruits abstract, will give us larger crops by stimulating a vigorous condition of the entire plant. A strong, healthy plant is, of course, better able to overcome interior local disorders, and to resist externally injurious influences more successfully, than feeble specimens.

To contribute something to the chemistry of fruit-culture, a series of field experiments with grape-vines and other fruits was undertaken at the Agricultural College, for the purpose of testing the action of certain special fertilizers on their productiveness in the quantity and quality of the fruit, and to ascertain whether a favorable change in their quality is accompanied with a definite alteration in the relative proportion of their mineral or ash constituents.

The variety first selected was the Concord grape, which originated from the common wild purple grape (*Vitis Labrusca*).

The vines under treatment are growing in three plots in the college vineyard, located upon a hill sloping toward the south, and protected upon the north by a heavy growth of timber. The vines were planted in 1868 and 1869, and received no manure except wood-ashes, which had been applied some years previous to these experiments. Each plot consists of three rows of Concord vines, and six in each row. Fertilizers were first applied in the spring of 1873.

The plots were numbered from the west side, and fertilizers applied numbered in the same way. In 1874 twelve wild vines of the purple and white varieties of *Vitis Labrusca* were taken from near a pond in the vicinity, and

planted in these plots. The soil of the vineyard consists of a gravelly loam, a drift formation, of good depth.

The fertilizers used, numbered the same as the plots, are as follows:—

No. 1. 450 pounds superphosphate, 12 per cent soluble phosphoric acid; 180 pounds nitrate of potassa.

No. 2. 250 pounds sulphate of magnesia (crude Kieserite); 180 pounds nitrate of potassa.

No. 3. 450 pounds superphosphate, 12 per cent soluble phosphoric acid; 250 pounds sulphate magnesia (crude Kieserite); 180 pounds nitrate of potassa.

The superphosphate giving about fifty-four pounds of soluble phosphoric acid; the amount of nitrogen, about twenty-four pounds; the potassium oxide, eighty pounds; and the magnesium oxide, thirty-eight pounds.

The following subjects were proposed for careful analytical investigation:—

First, What are the chief characteristic organic and inorganic constituents of the Concord grape as compared with those of the wild varieties of *Vitis Labrusca* (L.), the vine from which the Concord originated?

Second, To what extent is it possible to alter the quality and the quantity of their ash constituents in the fruit of both varieties? and, in case such alterations are noticed, what are the consequences of changes of that kind in the *relative quantity* of their most characteristic organic constituents, as sugar, acid, &c.?

The solution of these questions may require some years of study; but every fruit-grower must recognize their importance, while it is evident that they suggest the possibility of progress, and point out the way for future study and observation which may lead to valuable practical results,—valuable not to the grape-grower alone, but to the cultivator of every variety of fruit.

The growth the first year after the application was remarkably good, the foliage being of very dark color; and, while vines in the other parts of the vineyard suffered from mildew, those fertilized were nearly free from its injuries. The fruit was larger and of better quality.

The first analyses forming the bases of future comparison are as follows:—

I.

The Amount of Sugar in Various Varieties.

Variety.	Time when collected.	Time when assorted.	Amount of Grape-Sugar (per cent).
Concord	Sept. 24	Sept. 24	9.95
Delaware	24	24	12.97
Concord	23	28	10.48
Concord (twice frozen) . .	Oct. 14	Oct. 14	10.77
Israella	Sept. 28	Sept. 28	9.80
Concord	25	Oct. 22	14.50
Delaware	25	25	23.50
Agawam	27	14	13.55
Ives Seedling	28	Nov. 1	12.76
Clinton	28	1	17.30
Natural Seedling . . .	20	Oct. 5	10.39

A careful comparison of these few figures shows not only the striking difference in the percentage of sugar in the juice of several well-known varieties, but it makes conspicuous the fact that the different kinds lose their moisture at quite different rates under ordinary circumstances. The increase in the sweetness of the grape is not due to a process of after-ripening, but to a loss of moisture, in consequence of keeping, after their removal from the vine.

II.

Main Organic Acids.

An examination of the juice from the ripe grape proved the absence of malic acid and oxalic acid, and established the presence of varying quantities of tartaric acid in a free state.

III.

Ash Constituents of the Fresh Juice of the Ripe Grape.

The unfermented and fermented juice obtained Oct. 9, 1874, contained its essential mineral constituents in the following proportion : —

Unfermented Juice.	Per cent.	Fermented Juice.	Per cent.
Potassium oxide	50.85	Potassium oxide	40.69
Sodium oxide	.48	Sodium oxide	–
Calcium oxide	3.69	Calcium oxide	6.85

UNFERMENTED JUICE.	Per cent.	FERMENTED JUICE.	Per cent.
Magnesium oxide . .	4.25	Magnesium oxide . .	6.24
Sesquioxide of iron . .	.10	Phosphoric acid . . .	9.04
Phosphoric acid . . .	6.43		
Silicic acid	.90		

The sediment found during fermentation contained in its air-dry state 56.78 per cent of potassium oxide, and, at 100° to 110° C., 4.6 per cent of moisture.

IV.

Ash Constituents of the Wood.

One year old wood of the Concord grape-vine furnished in its air-dry state 2.969 per cent of ash. One hundred parts of the ash contained the following relative proportions of the essential mineral elements of plant-food: —

	Per cent.		Per cent.
Potassium oxide . . .	22.57	Magnesium oxide . .	4.28
Sodium oxide	–	Phosphoric acid . . .	14.07
Calcium oxide . . .	9.72	Silicic acid	23.84

V.

Analysis of the Seed.

One hundred parts of air-dry seeds of the Concord grape, which lost, at 100° to 110° 1′, 6.18 per cent of moisture, contained 1.081 parts of nitrogen, and left by calcination 3.076 parts. The ash contained, in one hundred parts: —

	Per cent.		Per cent.
Potassium oxide . . .	6.71	Magnesium oxide . .	3.03
Sodium oxide	–	Phosphoric acid . . .	17.20
Calcium oxide	–	Silicic acid . . .	.29

VI.

Analysis of the Grape Skins and Pulp.

One hundred parts of air-dry skins and pulp left, after the juice had been removed, .91 per cent of ash; they contained 1.625 per cent of nitrogen, and left, at 100° to 110° C., 8.5 per cent of moisture. One hundred parts of the ash contained: —

	Per cent.		Per cent.
Potassium oxide	7.70	Phosphoric acid	24.40
Sodium oxide	.42	Sesquioxide of iron . . .	.08
Calcium oxide	57.36	Silicic acid	1.32
Magnesium oxide . . .	8.80		

VII.

Analysis of the Stems of the Grapes.

One hundred parts of the stems of the Concord grapes in an air-dry state contained 9.64 per cent of moisture and 1.182 parts of nitrogen : they left by calcination 4.688 parts of ash, which contained in one hundred parts the following mineral elements : —

	Per cent.		Per cent.
Potassium oxide	20.91	Magnesium oxide . . .	8.45
Sodium oxide . . .	Not det.	Phosphoric acid	17.75
Calcium oxide	20.20	Silicic acid	2.09

VIII.

Analysis of the Young Branches, with Tendrils and Blossoms, collected June 15, 1876.

Moisture lost at 100° to 110° C., 80.80 per cent ; dry matter, 19.20 per cent.

One hundred parts of their ash contained, —

	Per cent.		Per cent.
Potassium oxide . . .	24.7102	Ferric oxide	1.0773
Sodium oxide	.9442	Phosphoric acid . . .	17.1590
Calcium oxide	40.5302	Matter insoluble in dilute	
Magnesium oxide . . .	10.6611	hydrochloric acid . . .	4.9180

The above tables give a very clear idea of the distribution of the essential mineral elements in the various parts of the Concord grape at the end of the season, and it would seem that these elements must have their peculiar influence upon the formation of each part where found in large quantities.

To more thoroughly understand the condition of the fruit in its growth during the season, analyses were made at intervals in 1876, and tests applied to determine the amount of sugar and acid. The tests were made at times when there was a distinct change or maturing of some part of the vine.

The increase of organic and saline constituents was determined by expelling the moisture at 100° Centigrade. The juice was pressed out with a small iron hand-press, and the specific gravity and per cent of grape-sugar and acid determined by the customary analytical methods.

The juice collected June 17 was examined, and found in a thin, watery condition, and by certain test showed the purple coloring-matter to be present even at that early period.

Organic Matter of Concord Grape.

1876.	July 17.	July 20.	Aug. 2.	Aug. 16.	Aug. 30.	Sept. 13.	Oct. 4.
Berries lost moisture at 100° Centigrade	91.7000	91.900	90.060	89.120	84.420	82.520	80.180
Percentage of dry matter left at 100° Centigrade . .	8.3000	8.100	9.940	10.880	15.580	17.480	19.820
Percentage of grape-sugar in the dry matter of berries .	7.7700	7.720	9.440	18.380	55.330	79.460	81.380
Specific gravity of the juice .	1.0175	1.015	1.020	1.025	1.050	1.067	1.070
Temperature of the juice, Centigrade	31°	31°	25°	28°	25°	23°	18°
Percentage of grape-sugar in the juice	0.6450	0.625	0.938	2.000	8.620	13.890	16.130
Percentage of free acid in the juice	–	2.040	3.525	3.240	1.698	0.778	0.696

The fruit upon the vines began to change in color the 15th of August, commencing in the stems, and soon passing to the berries; and Aug. 30 the color had increased to such an extent as to give a bluish-purple precipitate with a solution of basic sugar of lead.

The table shows, that, at the time when the first coloring occurred, a great change was taking place in the growth of the grape. The free acid, which had reached its highest point the first week of August, lost fifty per cent before Aug. 30. Grape-sugar began to increase rapidly when the free acid decreased. Aug. 2 all the acid was in solution; and the decrease was due to its being changed into insoluble compounds of lime and potassa in crystalline form, and not, as claimed by Liebig and others, to the change of the acid into grape-sugar.

The mineral constituents show no less change during growth, as will be seen by the following table: —

Ash of Concord Grape (Unfertilized).

1876.	July 7.	July 17.*	Aug. 18.	Sept. 13.
Potassium oxide	41.73	47.34	51.14	57.15
Sodium oxide	5.04	1.13	3.19	4.17
Calcium oxide (lime)	25.03	24.21	16.20	11.30
Magnesium oxide	7.80	Not det.	6.38	3.10
Ferric oxide	0.55	0 75	0.65	0.40
Phosphoric acid	18.48	21.38	20.77	12.47
Silica and insoluble matter	1.37	0.43	1.67	11.83

Ash of Concord Grape (Fertilized).

Oct. 3, 1878.	Per cent.		Per cent.
Potassium oxide	64.65	Ferric oxide	.50
Sodium oxide	1.42	Phosphoric acid	14.87
Calcium oxide	9.13	Insoluble matter	5.80
Magnesium oxide	3.63		

It will be noticed that the changes resulting from the application of the special fertilizers, superphosphate and potash, are very marked in the increase of these two constituents of the ash; and, by comparing the above with the organic analysis of the wild natural seedling, it will be seen that there is a corresponding increase in the most important organic constituent (the sugar), and a decrease of free acid.

The wild seedling was taken for the organic analysis from the fact that it was supposed to be in a more natural condition, and that the effect of special fertilizers would be more marked. In the ash analysis of the Concord grape the increase of potassium oxide is 7.50 per cent, and that of phosphoric acid, 2.40 per cent. In the organic analysis of the wild seedling the increase of sugar in the solid parts was 9.80 per cent, and in the juice 5.29 per cent; and the free acid in the juice was found to have decreased 8.69 per cent.

The ability to effect such decided changes in the composition of our fruits cannot but be of the greatest importance to horticulturists in improving the quality of the now cultivated varieties, and also in producing new varieties of a desired quality. If we can change the composition of our fruits in one or two of its elements, by the application of the proper food, why cannot we change the proportion of any element? In the seed is stored up the element of the

new plant, and the varied compositions may be accompanied by certain physiological changes which shall determine the character of the variety.

A more certain and direct method of producing new varieties by hybridization may be opened if we know positively the chemical composition of the varieties used as parents, or if we can, as indicated by the above and many other striking illustrations, bring about the desired changes in the most essential parts. If we select the varieties for crossing in which the most desired elements are accurately known to exist, is it not probable that we shall have better success than if we worked in the ordinary way?

To obtain correct information in relation to the natural condition of the wild seedling, healthy vines were selected, growing near a pond in the vicinity, and rooted layers transplanted to the experimental plots in the college vineyard. Both the white and purple varieties of *Vitis Labrusca* (*L.*) were used. Fruit was collected for analysis from the original vine, which had received no fertilizer; while those transplanted to the vineyard were fertilized with Fertilizer No. 1 from the time of their removal. The fertilizers used were a hundred and eighty pounds of potash nitre and four hundred and fifty pounds of superphosphate of lime, containing twelve per cent of soluble phosphoric acid. The transplanted vines yielded fruit the second year after transplanting.

The analysis given below was confined to the determination of the constituents of the solid organic matter, the sugar, and the free acid.

[A.]

I. — *Berries of the Wild Purple Grape* (*without Fertilization*).

1877.	Loss of Moisture at 100° C.	Dry Matter after exposure to 100° C.	Grape-Sugar in 100 parts of Dry Matter.
July 19	91.00	9.00	7.49
Aug. 4	87.75	12.25	8.94
16	87.52	12.48	16.58
30	83.42	16.58	39.81
Sept. 20	83.69	16.31	49.25

II. — *Berries of the Wild Purple Grape (after Treatment with Special Fertilizers).*

1877.	Loss of Moisture at 212° F.	Amount of Dry Matter after heating to 212° F.	Grape-Sugar in 100 parts of Dry Matter at 212° F.
Sept. 20	80.45	19.55	69.10

As a result of cultivation and fertilization, there was a gain of nearly twenty per cent of grape-sugar.

[B.]

I. — *Juice of Berries of Wild Purple Grape (without Fertilizers).*

1877.	Specific Gravity.	Temperature, C.	Percentage of Grape-Sugar in Juice.	Percentage of Free Acid in Juice.
July 19	1 020	31°	0.714	1.927
Aug. 4	1.020	28°	1.100	3.523
16	1.025	28°	2.000	3.296
30	1.050	26°	6.500	1.394
Sept. 20	1.045	16°	8.220	9.840

II. — *Juice of Berries of Wild Purple Grape (with Special Fertilizers).*

1877.	Specific Gravity.	Temperature, C.	Percentage of Grape-Sugar in Juice.	Percentage of Free Acid in Juice.
Sept. 20	1.065	16°	13.51	1.149

In these cases the result of the use of special fertilizers is shown by the increase of grape-sugar (from eight to thirteen per cent), being nearly as much as was found in the Concord variety at the same date.

[C.]

Ash Analysis: I. — *Of the Uncultivated Wild Grape.* II. — *Of the Cultivated and Fertilized Wild Grape.*

	I.	II.
Potassium oxide	50.93	62.65
Sodium oxide	0.15	0 85
Calcium oxide (lime)	22.23	14 24
Magnesium oxide	5.59	3.92
Ferric oxide	0.79	0.53
Phosphoric acid	17.40	13.18
Insoluble matter	2.93	4.63

The difference in the ash constituents of the fertilized and the unfertilized vines is as marked as are the organic elements.

To determine the composition of the various kinds of grapes, the following analyses were made during the seasons of 1876 and 1877. The specimens for these tests were obtained, with a few exceptions, from the college vineyard.

DATE.	Specific Gravity.	Temperature, Centigrade.	Moisture lost at 100° to 110° Centigrade.	Percentage of Dry Matter at 100° to 110° Centigrade.	Percentage of Grape-Sugar in the Juice.	Percentage of Grape-Sugar in the Dry Matter.	Amount, in cu. cent., of Soda Solution to neutralize 100 parts of Juice.
Hartford Prolific.							
1876.							
Sept. 5	1.06	22°	82.61	17.39	13.89	79.87	8 88
Ives Seedling.							
Sept. 6	1.07	26°	79.85	20.15	15.15	75.14	8.86
Iona.							
Sept. 7	1.08	21°	75.44	24.56	15.15	61.68	144.00
Iona (Mildewed).							
Sept. 7	1.045	26°	85.59	15.41	6.25	40 56	204.40
Agawam.							
Sept. 11	1.075	20°	79.21	20.79	17.24	82.92	94.80

Date.	Specific Gravity.	Temperature, Centigrade.	Moisture lost at 100° to 110° Centigrade.	Percentage of Dry Matter at 100° to 110° Centigrade.	Percentage of Grape-Sugar in the Juice.	Percentage of Grape-Sugar in the Dry Matter.	Amount, in cu. cent., of Soda Solution to neutralize 100 parts of Juice.
			Wilder.				
1876.							
Sept. 11 . . .	1.064	20°	83.47	16.53	13.67	82.69	5.600
			Delaware.				
Sept. 12 . . .	1.08	24°	76.51	23.47	17.86	76.09	74.00
			Charter Oak.				
Sept. 12 . . .	1.08	24°	84.02	15.98	8.77	54.94	168.30
			Israella.				
Sept. 16 . . .	1.075	23°	80.33	19.67	9.20	46.77	89.80
			Reutz Seedling.				
Sept. 20 . . .	1.08	21°	78.35	20.65	16.13	78.11	181 80
			Adirondack.				
Sept. 20 . . .	1.065	21°	84.89	15.11	13.17	87.16	68.00
			Catawba.				
Oct. 16 . . .	1.08	13°	76.55	23.45	17.39	74.16	82.00
			Wilder.				
1877.							
Sept. 11 . . .	1.065	23°	83.59	16.41	15.15	92.23	60.00
			Charter Oak.				
Sept. 12 . . .	1.055	23°	83.78	16.22	9.80	60.42	96.00
			Concord.				
Sept. 13 . . .	1.065	24°	84 10	15.90	13.16	82 76	102.00
Sept. 26 . . .	1.075	24°	80.66	19.34	15.43	79.78	70.80
			Eumelan.				
Sept. 24 . . .	1.065	16°	80.38	19.62	13.16	67.07	73.00
			Wild White Grape (not Shrivelled).				
Sept. 5 . . .	1.050	22°	84.43	15.57	7.20	46.24	140.80

(Specimen Shrivelled.)

Date.	Specific Gravity.	Temperature, Centigrade.	Moisture lost at 100° to 110° Centigrade.	Percentage of Dry Matter at 100° to 110° Centigrade.	Percentage of Grape-Sugar in the Juice.	Percentage of Grape-Sugar in the Dry Matter.	Amount in cu. cent., of Soda Solution to neutralize 100 parts of Juice.
1877.							
Sept. 20 . . .	1.060	16°	79.98	20.02	10.00	49.95	130.00
Wild Purple Grape (Shrivelled).							
Sept. 20 . . .	1.045	16°	83.69	16.69	8.22	49.25	104.00

The juices of the different kinds of grapes above mentioned behave quite unlike when treated with basic acetate of lead, producing different colored precipitates. These colors seem to result from the presence of several distinct colored pigments in the grape, peculiar, in all probability, to the wild species from which they originated. This re-action may prove of some practical use as an aid in tracing the origin of the various cultivated varieties.

Dr. Engleman, in his excellent description of the true American grape, incidentally states that some growers consider the Delaware and Clinton as derived from the same species, *Vitis cordifolia, var. riparia* (Gray), the common frost or winter grape. This appears doubtful, judging from the re-action above mentioned, and as shown in the following table: —

Wild Purple Grape Hartford Prolific Concord Wilder Ives Seedling Israella Isabella Clinton	Precipitate from light purple and bluish-green to slate-color.
Wild White Grape Iona Delaware Charter Oak Eumelan Agawam	Precipitate from bright sulphur-yellow to cream-color.

During the summer and autumn of 1877 some experiments were begun to learn the effect of girdling the vines. The practice of girdling, or taking out a ring of the bark below the fruit, to increase its size, for exhibition purposes, has long been understood; but the effect this treatment has upon the composition of the fruit, or its influence upon the health of the vine, has received but little attention.

The first vines were girdled the first week in August, by removing a ring of bark of from one-eighth to one-half of an inch. Careful chemical analysis was made, from time to time, of the fruit of the girdled vine, and of that from the ungirdled vines also, growing side by side.

Six varieties were treated; but complete tests were made of only one variety, i.e., the Concord. At this time (Aug. 1) the free acid of the berries had reached its highest point, and the sugar was beginning to increase. The stems of the berries had commenced to turn. In some cases, entire vines were girdled; in others, only one or more branches. A change was noticed in a few days in the growth and color of the leaves, and a distinct increase in the size of the berries. This change continued up to the period of ripening, which was clearly between two and three weeks earlier than the fruit from ungirdled vines beside them. The grapes on the girdled vines, when ripe, were of the same composition as those from the ungirdled ones, showing the prevalent idea of horticulturists, that this treatment produces grapes of an inferior quality, to be incorrect.

The following table shows the changes taking place during a period of about one month:—

Hartford Prolific (not Girdled).

Date.	Specific Gravity of Juice.	Temperature, Centigrade.	Moisture lost at 100° to 110° Centigrade.	Dry Matter at 100° to 110° Centigrade.	Percentage of Grape-Sugar in Juice.	Percentage of Sugar in Dry Matter.	Amount, in cu. cent., of Soda Solution to neutralize 100 parts of Acid.
1877.							
Sept. 3 . . .	1.045	19°	87.15	12.85	8.77	68.25	111.40

Girdled.

Date.	Specific Gravity of Juice.	Temperature, Centigrade.	Moisture lost at 100° to 110° Centigrade.	Dry Matter at 100° to 110° centigrade.	Percentage of Grape-Sugar in Juice.	Percentage of Sugar in Dry Matter.	Amount, in cu. cent., of Soda Solution to neutralize 100 parts of Acid.
1877.							
Sept. 3 . . .	1.065	19°	82.82	17.18	12.50	72.76	100.00
Wilder (not Girdled).							
Sept. 3 . . .	1.055	19°	84.59	15.41	10.42	67.62	108.20
Girdled.							
Sept. 3 . . .	1.075	19°	82.76	17.24	14.70	85.26	88.40
Delaware (not Girdled).							
Sept. 4 . . .	1.065	19°	84.25	15.75	11.76	74.66	101.20
Girdled.							
Sept. 4 . . .	1.075	19°	80.86	19.14	15.15	79.16	94.40
Agawam (not Girdled).							
Sept. 4 . . .	1.060	19°	83.40	16.60	11.37	68.48	128.20
Girdled.							
Sept. 4 . . .	1.075	19°	81.55	18.45	16.13	87.42	114.80
Iona (not Girdled).							
Sept. 6 . . .	1.0625	22°	80.37	19.63	13.51	68.31	131.40
Girdled.							
Sept. 6 . . .	1.085	22°	78.52	21.48	15.63	72.76	125.60
Concord (not Girdled).							
Sept. 6 . . .	1.045	22°	86.54	13.46	7.46	55.42	182.40
Girdled.							
Sept. 6 . . .	1.070	22°	82.47	17.53	13.88	79.18	102.80
Not Girdled.							
Sept. 26 . . .	1.065	22°	82.37	17.63	13.70	78.27	86.00

Girdled.

Date.	Specific Gravity of Juice.	Temperature, Centigrade.	Moisture lost at 100° to 110° Centigrade.	Dry Matter at 100° to 110° Centigrade.	Percentage of Grape-Sugar in Juice.	Percentage of Sugar in Dry Matter.	Amount in cu. cent., of Soda Solution to neutralize 100 parts of Acid.
1877.							
Sept. 26	1.080	22°	75.53	24.47	19.61	80.13	76.80
Not Girdled.							
Oct. 5	1.075	12°	79.08	20.92	17.86	85.37	42.00
Girdled.							
Oct. 5	1.085	12°	–	–	17.50	–	54.00

It will be noticed that the grapes upon the girdled vines differed widely from those from the ungirdled ones during the earlier examinations, but that later in the season both reached the same state of maturity. The amount of grape-sugar in the juice of the grapes from the girdled vines was several per cent less in October than in September; while there was a slight increase of density in the latter. Some of the grape-sugar must have undergone transformation between Sept. 26, and Oct. 5. The grape belongs to a class of fruit whose increase in sweetness, after its full development, is due to a loss of moisture, evidently by evaporation. The loss of moisture during this time very nearly corresponds to the increase of sugar in the solid matter of the grape. Grapes allowed to remain longer upon the vines soon showed a rapid change, free acid increasing in consequence of the formation of acetic acid by fermentation. This change is not confined to the grape: all our fruits are subject to the same change; and to retard this transformation is the aim of all successful methods of preserving fruits.

To obtain more definite and practical results, a series of experiments was planned and carried out the past season. The following questions were proposed as the basis from which to work: —

I. When is the best time to perform the operation?

II. What is best width of the girdle?

III. Shall the first cut be allowed to heal over, or be removed the second time?

IV. What is the effect of girdling upon the parts below the cut?

V. The effect upon the permanent health of the vine?

VI. The best plan for practical application?

VII. Profits of the operation?

To systematize the matter, the following plan was adopted; and the vines girdled in the different ways were labelled after the following manner:—

A,	old cane,	girdled,	$\frac{1}{4}$	inch wide . . .	but once.
B,	" "	"	$\frac{1}{4}$	" " . . .	kept open.
C,	" "	"	$\frac{1}{2}$	" " . . .	but once.
D,	" "	"	$\frac{1}{2}$	" " . . .	kept open.
E,	" "	"	$\frac{1}{8}$	" " . . .	but once.
F,	" "	"	$\frac{1}{8}$	" " . . .	kept open.
G,	new cane,	"	$\frac{1}{8}$	" " . . .	but once.
H,	" "	"	$\frac{1}{8}$	" " . . .	kept open.
I,	" "	"	$\frac{1}{4}$	" " . . .	but once.
K,	" "	"	$\frac{1}{4}$	" " . . .	kept open.

Following the above plan, one vine was girdled, in each of the above ways, each week from June 17 to Aug. 25, when the fruit was fast advancing toward ripeness. The vines treated were grown in the same part of the vineyard as those not treated, and were as nearly as possible in the same condition. They were closely watched, and any change noted as soon as it appeared up to Sept. 15.

Although the season was very late, yet some of the bunches were well ripened Sept. 5.

The results of the above experiments or answers, as far as can be given in the short time carried on, may be stated thus:—

1st, The best effect was noticed where the cut was made from July 1 to Aug. 1, and kept open by a second or third removal of the healing growth.

2d, The cut should be made about one half-inch in width. By making it of this width, there is less danger of its healing over, and the necessity of a second or third cut obviated. The girdling of the new wood was not a success; for, although the results were very marked in a few cases, yet most of the canes became broken by the wind.

3d, This was answered in connection with the first two, — that the cut must be made wide enough to prevent immediate growing over, or the growth must be removed a second or third time.

4th, No change was noticed upon the parts below the girdle, either in foliage or fruit.

5th, Those vines girdled two seasons ago have retained their vigor, and seem to be unaffected as far as the health of the plants is concerned; but a permanent effect was noticed in the earlier ripening of the fruit. This in some cases was nearly two weeks, as compared with those vines standing beside them. This increased earliness might perhaps be propagated with good results. What effect this hastened development may have upon the seed cannot now be determined; but, in the production of new varieties, this, as well as the effect of special fertilizers upon the seed, may open a new field for investigation.

6th, The practical application of this method may be obtained, and at the same time keep the vines well supplied with perfectly healthy matured new wood, by growing, every year two canes from each spur, as illustrated in Fig. 1. One of these canes, B, is to be cut back to two buds at the fall or winter pruning, while the other is left for girdling: this cane should be cut back to two or three feet, according to the strength of the vine, or the number of canes left for this purpose. The cane is girdled at A, and, after fruiting, is cut back to E, leaving two canes, C and D, for the continued treatment.

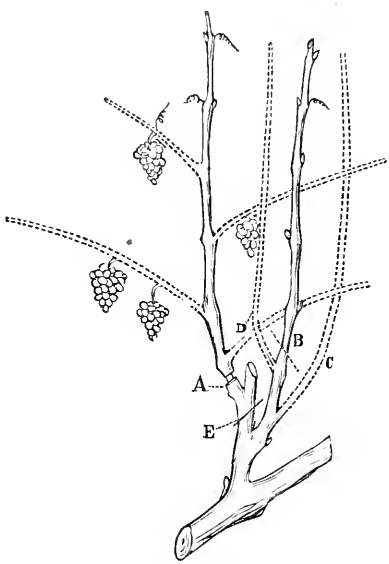


Fig. 1.

7th, Not having sold the fruit from the girdled vines separate from that of the remainder of the vineyard, the increase

in price could not be determined; but as such fruit as the grape always brings a much higher price when it first appears in the market than later, and the berries and the bunches were much increased in size, and as it could be put into the market fully two weeks before that from the ungirdled vines, it would probably have sold for from three to five cents per pound above the price obtained two weeks later.

Another advantage which may result from the girdling of the vine is the maturing of the fruit of many valuable varieties, which in the colder parts of our country now fail to ripen.

To facilitate the work of making the girdles, a small knife was constructed by which the cut was made very quickly. It is illustrated in Fig. 2, and is used by taking the cane in the left hand, and reaching around the cane in such a way that the knife can be turned completely around the cane at one stroke.

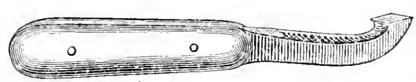


Fig. 2.

The knife is so made, that the bark is removed by the projecting point at the same time that the cut is made.

STARCH IN THE GRAPE-VINE.

Examinations have been made at various times with the microscope to determine the location of the starch stored up for the purpose of giving the vine a vigorous start in the spring, and supporting growth until the development of the leaves. It was found, that, in every part of the vine during the winter, the cells were closely packed with starch-grains, but that in some parts there were more than in others. In the main stem were found more than in the laterals; while in the root were less than in the mains or arms.

An experiment, suggested by the fact that starch was found so generally distributed throughout the parts of the vine, was undertaken during the winter of 1877 to determine which of the buds — those nearest the main canes upon new wood, those in the middle of the canes, or those at the extremities — would produce the best bunches of grapes. Three rows of vines were taken side by side, and six vines in each treated. In No. 1 two vines upon each row had all the

buds removed, but the second and third from the arms, upon all the canes of the last season's growth. In No. 2 all the buds were removed except two in the middle of each cane; while in No. 3 all but the two extreme well-matured buds were removed. The unexpected result was, that all the bunches were of nearly the same size, or as nearly as could be found upon vines in the same condition in any other part of the vineyard, — a result quite contrary to the theory upon which grape-vines are commonly pruned, i.e., that the two or three buds nearest the main cane will produce the best fruit.

It is the opinion of some of our best cultivators of the grape, that the rudiments of the blossoms which are to produce the fruit of the following season are to be found in the buds before the growth begins. This is true with many of our fruits, as the apple, peach, &c., but not so with the grape. The canes which produce the fruit must grow, and develop the fruit-buds, and perfect the fruit, all in one season.

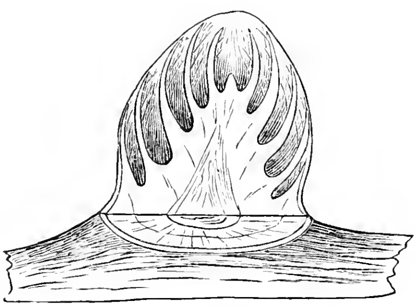


Fig. 3.

It is true the crop depends upon the growth of the previous season, and, the more vigorous and perfectly matured the wood, the better will be the fruit. Fig. 3 illustrates a section of the fully-developed bud of the Concord grape as it appears in January, magnified about ten diameters.

APPLE AND PEAR.

To be added to the above work of experimenting with special fertilizers upon fruits are the analyses of the apple, pear, cranberry, and strawberry.

The results obtained in the analysis of the apple are as follows: —

I. — *Apple (Baldwin).*

1877.	Amount of Dry Matter left at 100° to 110° Centigrade.	Amount of Moisture lost at 100° to 110° Centigrade.	Specific Gravity of Juice at 100° to 110° Centigrade.	Percentage of Sugar in Juice.
Sept. 1 . .	20.14	79.86	1.055	3.09
Oct. 9 . .	19.66	80.34	1.065	6.25
Nov. 27 . .	–	–	1.075	10.42

These three samples were taken from the tree on the day stated, and tested without delay.

Rhode-Island Greening.

1877.	Amount of Dry Matter left at 100° to 110° Centigrade.	Amount of Moisture lost at 100° to 110° Centigrade.	Specific Gravity of Juice at 100° to 110° Centigrade.	Percentage of Sugar in Juice.
Sept. 1 . .	20.27	79.73	1.055	3.16
Oct. 9 . .	19.68	80.32	1.066	7.14
Nov. 27 . .	20.25	79.75	1.080	11.36

The first two samples were tested directly after they were taken from the tree. The third, which resembled closely the second, when taken from the tree (Oct. 9), was wrapped in a paper, and kept in a close box: it was tested Nov. 27, or about seven weeks after being taken from the tree. A glance at the above results reveals the fact at once, that the Greening taken from the tree suffered similar changes in its composition as the Baldwin left on the tree.

In the ripening of the grape, it was noticed that there was no gain in the per cent of sugar after its removal from the vine, except by the evaporation of moisture; while in the *apple* and *pear* a very marked increase takes place. This would seem to indicate that the starch, which is always present in both fruits (the apple and pear), was converted into sugar.

II. — *Pear (Bartlett).*

1877.	Dry Matter left at 100° to 110° Centigrade.	Moisture lost at 100° to 110° Centigrade.	Specific Gravity of Juice at 12° to 15° Centigrade.	Percentage of Sugar in Juice.
Aug. 31 . .	15.00	84.99	1.060	4.77
Sept. 7 . .	16.55	83.45	1.060	5.68
20 . .	–	–	1.065	8.62
22 . .	–	–	1.060	8.93

The first three samples were tested when taken from the tree. The fourth was picked Sept. 7, and tested two weeks later: after hanging during this time in the ordinary atmosphere of a common room, it was found to have lost from seven to eight per cent in weight, and gained thirty-three per cent of sugar.

THE CRANBERRY.

The specimens of the cranberry which served for this test were furnished by parties engaged in their growth, and desiring to know the relative proportion of the essential elements of plant-food, for the purpose of determining what to return to the soil.

The following tables give the analyses of the fruit two weeks after harvesting.

One hundred air-dry weight parts contained: —

	1877.	1878.
Moisture lost at 100° to 110° Centigrade . .	89 200	89.890
Dry matter	10.710	10.110
Ash constituents in dry matter	–	0.170
Nitrogen in dry matter	–	0.160
Specific gravity of juice at 15° Centigrade .	1.025	1.025
Grape-sugar in juice	1.350	1.700
Free acid in juice	2.250	2.430

No cane-sugar was found; and the acid, probably, was of two kinds, — citric acid, or the acid of the lemon, and malic acid, or that of the apple.

The dried ash of the cranberries collected in 1877 contained: —

	Per cent.		Per cent.
Potassium oxide . . .	47.96	Ferric oxide	0.66
Sodium oxide . . .	6.58	Phosphoric acid . . .	14.27
Calcium oxide (lime) . .	18.58	Silicic acid and trace of sand	5.22
Magnesium oxide . .	6.78		

STRAWBERRY.

The variety which furnished material for the examination was the Wilder, and grew upon a piece of land which two years previous was in grass.

100 parts of fresh plants, without fruit, lost, at 100° to 110° C	72.26 parts of moisture
100 parts of fresh ripe fruit lost, at 100° to 110 ° C	89.03 to 90.31 parts of moisture
100 parts of average plants consist —	
of fruit	52 parts
of stem, root, and leaves . .	48 parts
100 parts of fresh plant left by calcination	3.34 parts of ash
100 parts of fresh fruit left by calcination	0.41 to 0.63 parts of ash

One hundred parts of ash contained as follows, in fruit (I.), and in plants without fruit (II.): —

	I.	II.
Potassium oxide	49.24	10.62
Sodium oxide	3.23	13.35
Calcium oxide	13.47	36.63
Magnesium oxide	8.12	3.83
Ferric oxide	1.74	6.91
Phosphoric acid	18.50	14 48
Silicic acid soluble in soda solution . . .	5.66	14.17

This is probably the first analysis of one of our native cultivated varieties; and it may be interesting to compare it with that of the wild native species (*Fragaria vesca*, L.) by Richardson.

One hundred parts of the fruit contained .41 parts of ash.

One hundred parts of that ash, calculated on the above specific basis, contained: —

	Parts.		Parts.
Potassium oxide	22.06	Ferric oxide	6.07
Sodium oxide	29.79	Phosphoric acid	14.47
Calcium oxide (lime)	14.88	Silicic acid	12.62
Magnesium oxide	Traces		

It will be seen by the above, that there is a great difference in the ash constituents of the two, — the wild strawberry and the above cultivated variety. The variations of the ash elements are no less remarkable than those of the organic constituents of sugar and acid. In the wild fruit the proportions are one of acid to two of sugar; while in the cultivated varieties the ratio is one to six, and more.

This question of the effect of the different fertilizing elements upon the character of the various products of the garden and orchard is of great importance to the practical gardener, and large results may be expected from investigations in this direction in the next few years.

Many of the most important questions of the times, upon horticultural practice, must be settled by the chemist's balance and the microscope. We cannot expect the solution of such questions as the degree of hardiness of plants as affected by special fertilizers or by growing naturally in soils of different composition, the laws which govern the production of new varieties from seed, the effect of the scion upon the stock, and the stock upon the scion, and many others, in any other way. The Massachusetts Agricultural College has facilities for such work, and has many experiments under way, which, with proper support, will result in much good to the people and to the college.

Adjourned.

THIRD DAY.

The Board met at ten o'clock A.M., JAMES S. GRINNELL, Esq., of Greenfield, in the chair.

Present: Messrs. Abbott, Anderson, Baker, Brown, Damon, Demond, Gleason, Goessmann, Grinnell, Hadwen, Herrick, Hersey, Lynde, Mayhew, Moore, Pierson, Slade, Sessions,

Taft, Varnum, Wakefield, Ware, Warner, Wheeler, and Wilder.

Mr. Moore, from the committee to consider and report upon the time and place of holding the public meeting, recommended that the Board meet at Southborough, on Tuesday, Wednesday, and Thursday, Nov. 30 and Dec. 1 and 2.

The Report was adopted.

Mr. Grinnell, for the committee to nominate two members of the Examining Committee of the Agricultural College, submitted the names of Mr. Wheeler and Dr. Lynde.

The nomination was confirmed.

Mr. Baker, from the committee on changes in the times of holding fairs, submitted the following: —

Your Committee appointed to consider any changes that may be desired by the several societies in the time of holding their annual fairs would respectfully recommend that

The Hingham Society begin its fair on the second Tuesday after the first Monday of September.

The Martha's Vineyard, the first Tuesday of October.

The Essex, the last Tuesday of September.

That the Worcester be authorized to hold its fair in conjunction with the New England Society.

For the Committee.

G. M. Baker.

The Report was adopted, and the changes made accordingly.

Mr. Wakefield, on behalf of the committee to consider and report upon the assignment of delegates, submitted the following: —

To the *Essex*	Mr. Demond.
" *Middlesex*	Mr. Lynde.
" *Middlesex North*	Mr. Hadwen.
" *Middlesex South*	Mr. Wheeler.
" *Worcester*	Mr. Brown.

To the *Worcester West*	Mr. Mayhew.
" *Worcester North*	Mr. Warner.
" *Worcester North-West*	Mr. Nichols.
" *Worcester South*	Mr. Herrick.
" *Worcester South-East*	Mr. Gaylord.
" *Hampshire, Franklin, and Hampden*	Mr. Ware.
" *Hampshire*	Mr. Slade.
" *Highland*	Mr. Preston.
" *Hampden*	Mr. Bowditch.
" *Hampden East*	Mr. Baker.
" *Union*	Mr. Anderson.
" *Franklin*	Mr. Gleason.
" *Deerfield Valley*	Mr. Hersey.
" *Berkshire*	Mr. Grinnell.
" *Hoosac Valley*	Mr. Taft.
" *Housatonic*	Mr. Damon.
" *Hingham*	Mr. Varnum.
" *Bristol*	Mr. Macy.
" *Plymouth*	Mr. Perkins.
" *Marshfield*	Mr. Sessions.
" *Barnstable*	Mr. Pierson.
" *Nantucket*	Mr. Moore.
" *Martha's Vineyard*	Mr. Wakefield.

The Report was accepted, and the assignment made accordingly.

Mr. Hawden, from the committee appointed to report upon Jersey and Guernsey cattle, submitted the following essay; the portion relating to the Jerseys prepared by himself, that relating to the Guernseys, by Mr. Bowditch.

JERSEY CATTLE.

Nearly thirty years have elapsed since the trustees of the Massachusetts Society for Promoting Agriculture imported Jersey cattle from the Island of Jersey for the purpose of improving our butter-dairy stock, and creating an interest in disseminating a breed so universally esteemed on their native island and in England as a family cow.

The early importations brought cattle about half the size of the natives; but their appearance did not secure the favorable opinion of farmers who were accustomed to measure the value of all cattle by avoirdupois. We had not then learned to appreciate the hidden qualities embodied in their

small, spare frames; while the delicate structure of their bodies looked as if they would be totally unable to withstand a single blast of northern wind; and we guessed with great unanimity that they were too delicately constituted for this climate.

The breeding, feeding, and care they had been accustomed to on their native island for so many generations were thought to be almost entirely unlike those to which our native cattle were subjected. Tethering on grasslands is the universal practice for animals, and stables for the night: no animals on the island are accustomed to range upon pastures. Under these conditions there is less demand for a large bony structure, — the natural outgrowth when grazed upon rugged hilly pastures.

The habits and the conditions under which they are kept on their native island have the tendency to give fineness of bone, and delicacy, to their whole structure.

As time has gone on, the foresight of the trustees in introducing a breed of cattle whose products place them in the front rank as butter-dairy animals, as well as for the family cow, where docility, beauty, and richness of product are combined, has been proved.

The people were reasonably satisfied with the milk and butter of other breeds, so long as they knew of none better; but, as the products of the Jersey cattle become known, they are highly prized and sought for.

As time has Americanized the Jersey cattle, they are not now of the same type of their ancestors when imported more than a quarter of a century ago. The different conditions under which they are reared and kept, the climatic changes to which they have been subjected, the different food and the manner of procuring it, — each and all these, having their influence, have physically changed the Jersey of the former type so generally disliked, to one whose symmetry and form are so much admired, and which delights the eye of a cultivated fancy.

Their size is now fully equal to the native animal, and they are as proverbially hardy, and thrive within the space of more than twenty degrees of latitude on this continent, and from the Atlantic to the Pacific. Perhaps no breed has ever been brought into the State that has more rapidly and

steadily grown in favor: hence they are to be found in all portions of the State, not only as the family cow, but often in large butter-dairies composed of other stock, where a few are kept to impart solidity, texture, and color to butter.

There are many large farms where they are bred as a specialty, whence the butter termed Gilt Edge is sold for the top market-price. Containing more nutritive properties, it is judged by those using it more economical, notwithstanding the higher price it bears in market.

Cream and milk from the Jerseys is also largely produced for sale in the towns and cities where the best article commands the best price; and the constantly growing demand is increasing the number of Jersey cattle within the State yearly.

The breeding of Jerseys for sale is also an important and growing interest. Cattle are kept on the farms of Massachusetts as carefully, and as closely guarded, as they are on their native island; and, where they are bred as a specialty, no other cattle should be kept, not even within sight of the males.

The fundamental principles and laws governing breeding animals of pure breeds are generally accepted and practised; and to keep up the march of improvement keeps the intelligent energy of the breeder ever active.

The familiar maxim that like produces like, to have due force with breeding animals should also be inseparably connected with care and feed equal to the type of animal desired.

The conditions appertaining to the structure and inherent powers of reproduction will not admit of any neglect on the part of the breeder, but are always dependent on his constant skill and care.

The breeding and feeding must be intelligent, uniform, and co-equal to build up or keep up any pure breed.

The especial characteristics of the Jersey cow have never been satisfactorily explained. How she gets more out of her feed, why her milk-product is of unequalled richness, and why the cows hold in milk for so long a time, it would seem must be attributed to nice selection, and uniform conditions of breeding and keeping for long-continued duration of time.

I have observed that the internal structure of the Jersey

cow is very rich and fatty. The fat stored and laid upon the inside by far exceeds the fat on the outer side next the skin. All the inside structure is heavily interlined and coated with fat; and the fatty richness of the internal tissues, it would seem, must have an influence on the richness of her milk-product.

I have also taken pains to observe other breeds when slaughtered, but have never found the inner fat in such undue proportion to the outside as I have found in the Jerseys.

The color of the fat is very deep yellow, which would seemingly have an influence in the color of Jersey butter.

The care and attention that our breeders have devoted to the Jerseys, have, through the excellence of the animals of the early importations, and the favorable circumstances which surround them, established strains of cattle in many respects evidently superior to those imported at later periods. While a few have forced their growth to the large and coarse animal (unnecessary in the dairy cow), many breeders have adopted conditions which have improved their form and bony structure, added a little to their size, and developed cows of medium size, fine points, and uniform appearance, which good breeding only can develop.

Thus the surplus of the Jersey herds is eagerly sought for from all parts of the country at remunerative prices; purchasers in this and other States having confidence in their breeding, and also their freedom from disease, — pleuro-pneumonia, &c. Jersey cattle of different strains differ in their appearance; but the Jersey cow of good strain and type should have clean and finely formed head, — not so delicate as to indicate want of stamina, nor so gamey as to indicate wildness; but head and body should be in good proportion to each other.

The face may be rather long or dishing, and tapering toward the muzzle, which should be encircled with light color. The eyes should be full, dark, with a pleasant expression, denoting intelligence and energy.

The ears and horns should be of symmetrical shape; the horns are sometimes crumpled, often spreading, and are seldom strong enough for self-defence in their frequent frolics.

The neck should be fine at the head, rather thin, and gradually deepening to fit the shoulder and chest.

The chest should indicate well-developed lungs.

The barrel should be large and deep: it is the factory to dissolve the food, and secrete the milk, and should be capacious (no body, no cow).

The ribs should be thin and flat, and well rounded out.

The back should be straight, and gradually widening from the shoulder to the hips. The hips should be broad and prominent, and the rump long from hips to tail. The tail should be long, tapering, and fine, and switch full, — white or black, as may please the fancy.

The legs should be fine, thin, and short; although we notice the tendency of the bones to enlarge where cattle graze on hilly pastures, also to increase in length when they are habituated to the tether and stables.

The hide or skin should be soft and mellow to the touch, and yellow where the secretions are undisturbed.

The udder should be capacious and well-developed, both forward and behind, should not be fleshy. The teats should be more than medium size, well set upon the udder; and the cow with small teats should be discarded as a breeder or milker.

The milk-veins should be large, running well forward, — the more crooked, the better: they are as sure an index of a cow as any external part.

While we like to see a well developed and defined escutcheon, after more than thirty years' observation we are still in the fog, and do not regard the escutcheon as the *ne plus ultra*.

We prefer the Jersey cow of medium size, or as large as may be without coarseness: coarseness is as much out of place in her structure as in any animal refined by careful breeding.

Symmetry and uniform shape and color are always strong and valuable points in families and strains of Jersey cattle, indicative of good breeding.

The color of Jerseys we consider more a matter of fancy than as having any influence on their dairy qualities.

Breeders have their fancy for light fawns with white, solid fawns, light and dark, black and light tongues, &c. We are

not, however, wedded to the dogma that color influences the dairy qualities of the cow, either by increasing or diminishing the flow of milk, or in any way affects her butter qualities, although color is fancy, and often has a marked influence on the prices of Jerseys.

Having bred sixty-seven animals, the progeny and descendants of one cow, and having solid and party-colored animals in nearly equal number, raised and kept under like conditions, we can discern no difference in their product which would appear to be in the slightest influenced by color.

Jersey cattle are to be found in the State of nearly every color, if we except red; and there are also to be found in large numbers several thousand that are pure-bred, and nearly if not quite as many grades.

Well authenticated statements are to be found in the annual Transactions of the Agricultural Societies, of the large yield of milk and butter from the Jersey cow, with weekly newspaper statements of their large product.

Their rapid increase, not only in the State, but in the whole country, is the true index of their estimation as the cow especially for the butter-dairy.

In conclusion, I will add that the efforts made by the trustees of the Massachusetts Society, and by private individuals, to import and encourage the breeding of Jersey stock, both for the purpose of improving our common cattle, and especially for improving the product of the butter-dairies of the State, will be fully appreciated by practical farmers, wherever the Jersey is given a trial, also affording the best facilities of procuring superior animals at much less price than those imported.

O. B. Hadwen.

GUERNSEY CATTLE.

Guernsey cattle take their name from the Island of Guernsey, — one of the Channel Islands belonging to England, but lying near the coast of France.

The island contains about twenty-four square miles, and has a population of about twenty-five thousand.

The farms are, with one or two exceptions, very small; but on almost all of them a few choice cattle are bred, in color not unlike the fawn-and-white Jersey, only rather inclining

to a reddish fawn. Women take the entire charge of the cows and calves, which probably accounts for their extreme docility.

The farms being so small, the cattle are never allowed to run in pasture, but are tethered out, and moved from place to place several times during the day. It is not an unfrequent sight to see one woman leading half a dozen cows from the barn to the field, and with more ease than a man can lead one of our so-called quiet cows.

Nearly one thousand cows are exported annually, and, until the last few years, almost exclusively to England, where they are eagerly sought for private dairies.

These cattle combine many desirable qualities for the practical farmer; as in the first place they are large animals, and, when dry, fatten easily, and make a very fine quality of beef.

On the Island of Guernsey the butchers frequently kill cows that dress eight hundred pounds; and steers of this breed, of which many are in use on the island for farm purposes, weigh from eleven hundred to fourteen hundred pounds. These figures are taken from a Guernsey paper.

The above are only average weights, as I have now a five-year-old imported bull which has had no grain at all for three years, that weighs sixteen hundred and twenty pounds. The cows will weigh from nine hundred to thirteen hundred pounds, the latter being above the average.

Their beef qualities and size, however, are perhaps of less consequence than their other good qualities. At the pail they prove themselves not only very large milkers (twenty quarts not being an uncommon yield for a mature cow, or fourteen quarts for a heifer with first calf), but they continue in milk very well up to their time of calving. Their udders are generally large and square, with good-sized teats. The quality of their milk is superior in color and richness to any other known breed; and butter made from pure Guernsey cream would be pronounced, even by experts, colored artificially, unless they were familiar with Guernsey butter.

The island records of butter productions give an average of one pound a day for the whole year; and selected cows would nearly double the amount.

In several experiments made in this country, between

seven and eight quarts of milk have made a pound of butter.

In the Farmington (Conn.) creamery, the milk of twenty Guernsey cows colored the butter from five hundred cows.

Until within ten years, very few of these animals were owned in Massachusetts, or, in fact, in New England. Most of the animals coming to this country were taken to Pennsylvania. A few years ago, however, the Massachusetts Society for Promoting Agriculture and three or four private individuals imported, and most of them still own, herds of these animals, and continue to breed them.

This breed seems to have the power of transmitting its valuable qualities to its grades; and many three-fourth bloods fully equal the thorough-breds at the pail.

E. F. Bowditch.

Feb. 3, 1880.

Mr. Ware, on behalf of the committee on subjects, submitted the following list, with the committees to which they were assigned: —

1. "The Improvement of Salt-Marshes." Messrs. Goessmann, Baker, and Lane.

2. "Raising and Selecting Field and Garden Seeds." Messrs. Moore, Hadwen, and Warner.

3. "Experiments in Potato-Culture." Messrs. Ware, Wheeler, and Hersey.

4. "What has Chemistry done for Agriculture?" Messrs. Nichols, Goessmann, and Abbott.

5. "Cultivation of Small-Fruits." Messrs. Brown, Slade, and Bowditch.

6. "The Basket-Willow and Culture." Messrs. Hersey, Herrick, and Pierson.

7. "What Influence does Farming as an Occupation have on the Mind?" Messrs. Baker, Varnum, and Warner.

8. "Is there Profit in Steaming Fodder for Cows?" Messrs. Sessions, Demond, and Bowditch.

9. "Poultry Raising." Messrs. Demond, Lynde, and Damon.

Professor Goessmann, at the request of the secretary submitted the following paper —

ON THE CULTIVATION OF THE SUGAR-BEET FOR THE MANUFACTURE OF SUGAR.

Our domestic resources for the manufacture of sugar have thus far, for various reasons, failed to meet our demand. We have produced annually from the sugar-cane, the sorghum, and the sugar-maple, only from one-sixth to one-fifth of what we consume; leaving an additional amount of from six hundred to six hundred and fifty thousand tons of sugar to be obtained by importation. This fact, in connection with the circumstance that the annual production of sugar from the beet-root in Europe, under climatical conditions similar to our own, has steadily increased, amounting at present to not less than from seven to eight hundred thousand tons annually, or about one-half of the entire consumption of that continent, has turned public attention to the question, whether, with intelligent management, the production of beet-sugar as a commercial enterprise can be profitably undertaken in Massachusetts, as it has been in many countries of Europe? whether we, like Germany, France, and Austria, can supply our home consumption of sugar by home production?

However the views of the friends of the beet-sugar interest may have differed at times in regard to its financial success as a mere industrial enterprise or as a source of a cheaper article of domestic manufacture, they all agree on one point, namely, that, in connection with agriculture, it has in Europe proved to be one of *the most important and most successful attempts to stimulate the introduction of sound principles into agricultural pursuits, to develop rational agriculture, and to promote a healthy feeling of a common interest between agriculture and manufactures, between capital and labor.* Improved farm management, and a rapid progress in the modes of separating the sugar economically, went hand in hand. European agriculturists have brought about this thrifty union of industrial and agricultural interests by devoting themselves with untiring perseverance to the task of producing a sugar-beet which contains the largest possible amount of sugar in the most favorable condition for extraction.

A high percentage of sugar in the beet-root is not the sole, though a most important requirement. The great aim

has been the production of a beet which *contains the largest possible amount of sugar with the smallest possible percentage of foreign substances, whether saline, nitrogenous, or non-nitrogenous organic compounds;* for practice has clearly established, that, for every percentage of foreign admixture, about one and a half per cent of sugar in the juice will be rendered uncrystallizable, and thus converted into a less valuable molasses.

Judging, therefore, from experience elsewhere, it is but reasonable to assume, that the solution of the problem, whether beet-sugar manufacture can succeed with us as a paying enterprise, will prove to depend here, as has been the case in Europe, on the interest which intelligent farmers will take in raising a sugar-beet from which the sugar can be extracted economically.

The present paper is designed to embody the facts which have been worked out in the development of the sugar-beet cultivation and the beet-sugar manufacture abroad, and also to state the results of personal investigations carried on for years to ascertain the extent of our domestic resources for the successful introduction of the beet-sugar industry in our midst.[1]

SOIL FOR THE SUGAR-BEET.

The best soil for the cultivation of sugar-beets is a mellow, deep, sandy loam, with a free and permeable subsoil, — a soil called by German farmers a rich, first-class barley soil. A sandy loam, if deep, and rich in well-decomposed organic matter, is preferable to a clayey soil; for the latter becomes too compact and hard in a dry season, particularly after heavy showers, and so frequently interferes with the growth of the fleshy roots; and in wet seasons it produces a watery beet inferior in saccharine properties. In case the subsoil is not perfectly free, under-drainage is indispensable. A rocky soil, or a thin surface-soil with gravelly subsoil, or a deep virgin soil with large quantities of half-decayed vegetable matter, is very objectionable; and stagnant waters cause the premature decay of the roots at their lower extremities.

Suitable physical properties of the soil are of the first

[1] See Reports viii., ix., x., xi. of the Trustees of the Massachusetts Agricultural College, 1871-75.

importance; for fitness of soil, as far as a necessary amount of plant-food is concerned, may be secured by a carefully selected system of rotation, aided by a proper selection of special manures. Inferior kinds of soil may in some exceptional cases answer for beet-sugar cultivation, yet they ought not to be relied upon as a safe basis for beet-sugar manufacture.

Extremes of soil, or much exhausted lands, are not, as a general rule, to be recommended for the cultivation of many crops. Cheapness does not always imply economy.

The successful cultivation of special crops for a definite industrial purpose requires lands on which the farmer can control their growth by a special system of manuring, or otherwise, and so promote the development of qualities which increase their commercial value. The grower of tobacco for smoking, for instance, aims at the production of leaves which do not char when burned; and the cultivator of sugar-beets for the manufacture of sugar must aim to produce roots which contain the largest possible amount of sugar under the most favorable conditions for economical extraction. Soils which are overcharged with soluble mineral elements and unusual quantities of nitrogenous substances, resulting from a decaying vegetation, produce a luxuriant growth, which in the beet-root is unfavorable to the main object of its cultivation; namely, the successful, economical manufacture of sugar. Wood-lands and prairie-lands but recently brought under cultivation offer little encouragement for starting in the beet-sugar industry: they may produce excellent results later on, or after repeated cropping, especially if they incline to be sandy, and have a permeable subsoil.

TREATMENT OF THE SOIL.

The rules for preparing the soil may be summed up as follows: manure in the fall, and plough the manure in deep (if obliged to manure in the spring, use only well rotted compost); begin the work in the fall at any rate, and turn the soil two or three times; do not work the soil when wet; pulverize it with the best implements, and just before sowing the seed; let not much time be lost between the last mechanical operation and the seeding.

A careful attention to deep ploughing is highly recommended, provided the subsoil is of fit quality. The soil should never be ploughed less than eight inches: from ten to sixteen inches, or deeper, is desirable. Wherever deep ploughing is undertaken for the first time, it is done in the fall, and the lands are to be well manured immediately afterwards.

To increase the efficiency of this treatment, a well-considered four-years' course of rotation of crops is adopted. Not more than one-fourth of the entire area of lands under cultivation is at any time planted with beet-roots. The selection of crops for the rotation is made with a view to benefit the physical and chemical condition of the soil, and to favor economy in fertilizers. The preceding crop is considered of particular importance. As wheat grows well in richly-manured soil, it is the prevailing crop upon first-class lands; rye and barley are chosen in less favorable circumstances. Green fodder, or leguminous plants, as clover, &c., are raised from time to time, to aid in the mechanical preparation of the soil, and to help enrich the land by increasing the mass of organic plant-food.

MANURING LANDS FOR SUGAR-BEETS.

Stable-manure is the basis of the whole system of manuring: commercial or artificial manures are relied on only as supplementary. For this reason, sugar-beets are usually raised as a second crop in the rotation, giving a chance for a thorough disintegration of the stable-manure: the effect of the latter is supplemented the next spring, and previous to planting the beet-seed, by a special commercial manure. The condition and composition of the soil naturally control the whole system of manuring. As soils will differ in both respects, practical experience does not show that any one manure will answer under all circumstances. We know what kind of manure has a good effect, and what has a bad effect, on the sugar-beet, as far as the percentage of sugar, and its final extraction, are concerned. The production of sugar being the main object, the point on which the money-value turns, the farmer has to consult the interest of the sugar manufacturer. Large crops of watery sugar-beets are not economical, where, as in Germany, the beet-root is taxed.

In France, where the sugar resulting from the sugar-beet is taxed, spring manuring is more freely resorted to. The action of the stable-manure used the year previous to the raising of the beet-roots is increased by the addition of fertilizers of a more special character. Superphosphates containing from ten to twelve per cent of soluble phosphoric acid, or Peruvian guano, and concentrated Stassfurt, sulphate of potassa (from two hundred and fifty to three hundred pounds of each, or more, per acre), also wood-ashes with ground bones, or Chili saltpetre with superphosphates, applied in the fall, or at an early period of the spring, are highly recommended for that purpose. The condition of the soil and the amount of stable-manure previously used ought to decide as to the proper quantities.

Plants differ less in regard to *the various kinds* of food they need than in regard to *the quantities of each kind.*

The beet takes its food largely from the air, and, as the proper physical condition of the soil increases its power to absorb atmospheric plant-food, we find that stable-manure, and green crops turned under, are among the best fertilizers: the only caution needed is to apply them in time to have them disintegrated before the seed is sown. The successful sugar-beet grower sells nothing without replacing it in some form or other, except what he has drawn from the atmosphere, the sugar: he considers almost every thing else part of his real estate, which he cannot dispose of without injuring its value. Whatever he sells besides sugar is merely a matter of exchange: the mineral constituents, and, to a certain extent, the nitrogen which the articles sold contain, whether in the form of milk, grain, or live-stock produced upon his farm, he brings carefully back, either by buying fertilizers, or, better, by buying good and strong articles of fodder, as hay, corn, oil-cakes, &c., to manufacture the manure on his grounds.

Potassa and phosphoric acid are, strictly speaking, the only plant-constituents which have to be bought on account of the extensive stock-feeding which is usually connected with the farm management where the sugar-beet is cultivated for manufacturing purposes. This is especially the case where the molasses is sold; for that contains a very large portion of the soluble saline constituents of the beet-roots.

Fresh barnyard-manure, particularly of horses and sheep, or liquid stable-manure, or poudrette, and all manures containing uric acid, are decidedly objectionable in the spring preceding the sowing of the sugar-beet; for they cause an excessive growth of leaves, shortening thereby the time for the ripening of the roots, while favoring an increase of their nitrogenous constituents. They also cause a large absorption of saline constituents. In case barn-manure has to be applied in the spring for raising the sugar-beet, cow-manure is considered the least objectionable; but well-rotted compost is preferred.

The following series of experiments, carried on under my direction, may furnish an illustration regarding the extent of the influence of the system of fertilization, and the variety of soil on the quality of the beet raised from the same kind of seed.

A. — *Tests illustrating the peculiar effects of various fertilizers on the quality of the sugar-beet when raised upon the same piece of land, consisting of a brown sandy loam which had been well manured with stable-manure during the two seasons previous (1873-74).*

Kind of Fertilizer.	Percentage of Cane-Sugar found in Juice of Roots raised from the following Seeds:		
	Freeport, Ill.	Electoral College Farm.	Vilmorin College Farm.
Fresh horse-manure	11.96	9.42	7.80
Blood-guano, without potash	10.99	10.10	10.20
Blood-guano, with potash	12.55	13.24	10.50
Kainit and superphosphate	13.15	12.16	10.50
Sulphate of potassa	14 52	14.32	12.78
No manure; second year after stable-manure	13.49	12.78	12.19

It will be perceived that the result is very striking. The percentage of saccharine matter in the form of cane-sugar, where the fresh horse-manure was applied, is very low compared with that where the stable-manure had been applied the previous year, and where the concentrated fertilizers were used. This is sufficient to furnish a good general guide for intelligent practice. The quality of the beet is greatly modified by the condition of the fertilizer used.

B. — *Tests illustrating the effects of different modes of preparing the soil for the cultivation of the sugar-beet from the same variety of seed. The seeds used in these trials were furnished from one and the same package by the writer, and the beets were subsequently tested by him (1872–73).*

No. of Test.	Locality of the Beet-Field.	Saccharometer of Brix.	Percentage of Cane-Sugar.	Percentage of Foreign Substances in Solution.
1	Sing Sing, N.Y.	11.0°	7.80	3.20
2	Washington, N.Y.	14.0°	10.97	3.03
3	South Hartford, N.Y.	15.0°	11.70	3.30
4	Greenwich, N.Y.	12.0°	9.50	2.50
5	Frankfort, N.Y.	13.5°	11.00	2.50
6	Albion, N.Y. (*a*)	18.0°	15.10	2.90
	Albion, N.Y. (*b*)	14.0°	9.70	4.30

Test No. 6 was carried on to illustrate the *effect of the size of beets* upon *their quality.* "*a*" consisted of beets weighing from *a pound and a half to two pounds;* and "*b*," of beets weighing from *ten to fourteen pounds each.* Both were raised under similar conditions, upon the same land.

SELECTION OF VARIETIES.

The successful cultivation of the sugar-beet begins with the selection of seed-beets. Vilmorin's views on this subject are considered of great weight: a detailed statement of his rules may be found in the "Journal d'Agriculture Pratique," No. 5, 1858. He advises the selection of healthy, well-shaped beet-roots of from one and a half to two pounds' weight. Those which, with a large yield, show the most rings of leaf-marks, are preferred. The specific gravity of their juice ought not to be less than 1.05: those which contain a juice of from 1.06 to 1.07 specific gravity are of superior character. Some experienced beet-seed raisers test the fitness of a beet-root, as previously described, by means of a solution of common salt of from 8.5° to 9° Beaumé, specific gravity, rejecting those roots for seed production which swim upon the surface of the brine. Seed-beets ought not to be taken from a soil which is used for the first time for the cultivation of the sugar-beet. The amount of seeds obtained

from one acre varies from eight hundred to two thousand pounds. Our small demand for seeds has been, thus far, supplied from Germany and France. The White Imperial and Electoral sugar-beet, both of the Province Saxony, Prussia, besides Vilmorin's Improved Sugar-Beet, have yielded excellent results upon the College Farm. The inferior keeping quality of the Vilmorin beet-root limits its application.

NAME.	Source of Seed.	Weight, in pounds.	Percentage of Sugar in Juice.
I. — Vilmorin beet . .	Saxony	$\frac{3}{4}$ to $\frac{7}{8}$	15.50
II. — Vilmorin beet . .	"	$\frac{8}{4}$ to 1	15.61
I. — White Imperial . .	"	$\frac{3}{4}$ to $1\frac{3}{4}$	14.20
New Imperial . .	"	$1\frac{1}{4}$ to $1\frac{3}{4}$	13.80
I. — White Magdeburg . .	"	$1\frac{1}{2}$ to 2	13.10
Quedlinburg . . .	"	$1\frac{1}{2}$ to $1\frac{3}{4}$	13.44
II. — White Imperial . .	"	$1\frac{3}{4}$ to 2	10.27
II. — White Magdeburg . .	Silesia	$1\frac{1}{2}$ to $1\frac{3}{4}$	10.06
White Silesian . .	"	$1\frac{1}{4}$ to $1\frac{1}{2}$	9.72

Seeds raised upon the College Farm (1872) from some of the above-stated varieties of sugar-beets produced *roots* of a superior saccharine character.

As it may not be without interest to others to learn where to secure good seeds, I take the liberty to insert the communications of two well-indorsed parties, received quite recently.

Friedrich Dippe of Plotha, near Naumburg, A. S. Prussia, offers at the railroad depot, near home, *Vilmorin's Improved Sugar-Beet*, at forty-two marks for fifty kilogrammes (one kilogramme is equal to 2.2 pounds; one mark to 23.8 cents); *White Imperial Sugar-Beet*, fifty kilogrammes at thirty-three marks; *Small Wanzleben Sugar-Beet*, fifty kilogrammes at fifty marks.

O. Schlieckmann of Auleben, near Heringen Halle-Cassel, Province Saxony, Prussia, offers his *Improved Silesian White Sugar-Beet*, at fifty marks for fifty kilogrammes, at the railroad depot near home. This variety contains, according to the examinations of chemists of numerous German experiment stations, from fifteen to sixteen per cent of sugar.

SOWING THE SEED, AND TREATMENT OF THE SUGAR-BEET.

The seed is sown by hand or by machine: theoretically from two to three pounds would be necessary for one acre; but in practice from fifteen to sixteen pounds are used. The seeds, after being soaked in water, if to be sown by hand, are placed usually at a distance of fourteen inches apart; if sown by machine (of Garret's patent), they are dropped about eight inches apart in rows about twenty inches apart; which allows one horse with implement to pass between. In the latter case from twenty-eight thousand five hundred to thirty thousand plants could be raised upon one acre. A larger space around each plant favors an excessive enlargement of the roots, — a result not at all desirable, for large beets are usually watery.

Early planting is most desirable: it ought to be carried on as soon as the implements can pass over the ground without injuring the mechanical condition of the soil. In our section of the country, the fore part of May is best for planting.

A beet-root from one to one and one-half pounds is far better than one from two to three pounds. Every common beet-seed, containing by its natural construction from two to three germs, will produce as many plants, of which the strongest is left, whilst the rest are pulled up, or otherwise destroyed in due time. The process of thinning out the plants takes place as soon as the roots have reached a length of from three to four inches, and, if possible, shortly after a rain, to prevent the loosening of the soil around the specimen left. Transplanting sugar-beet plants from a separate bed to the lands for final cultivation is rarely resorted to: it is only recommended to fill out the gaps produced by the failure of seeds. Whenever this failure acquires any considerable proportion in the beet-fields, a re-seeding is preferred, provided the season has not too far advanced. The soil around the young plant should be frequently loosened by proper implements (every two or three weeks), and the roots kept carefully covered until the leaves have acquired their proper development, early in June. Such treatment destroys the weeds, and increases the hygroscopic and general absorptive properties of the soil, and thus highly favors

an undisturbed, early, and rapid development of the leaves. The latter, it is asserted, exert a controlling influence on the formation of sugar.

M. Vilmorin considers a large number of rows of leaf-marks an essential property of a good sugar-beet from which to raise seed. The leaves. as a general rule, absorb atmospheric food in proportion to their number and size. The sooner they acquire a good size, and the more numerous they are, the better are the chances of a copious formation of sugar; for this apparently depends to a great degree on the supply of atmospheric food. There are three distinct periods in the growth of the beet; viz., the development of the leaves, which ends usually in the first half of June; the formation of the roots, which is accomplished by the middle of September or first part of October; and, finally, the production of the seeds, which takes place in the second year. The ripeness of the roots is indicated by a change in the color of leaves from a deep green to a yellowish tint.

Those varieties which show a particular inclination to grow out of the soil are considered inferior. As soon as the leaves have reached their size, which happens in ordinary years usually in the fore part of June, the loosening of the soil and the covering up of the beet-roots cease, leaving them undisturbed in their growth. To convey some idea concerning the peculiar features in the growth of the sugar-beet plant, I insert here some of the results of an interesting investigation in this direction by Dr. P. Bretschneider. The weights are in grammes, one gramme being equal to 15.43 grains: —

Date.	Weight of the Root.	Weight of the Leaves.	Proportion between Root and Leaves.	Percentage of Sugar.
June 12	0.2005	–	–	2.13
21	5.3000	–	–	4.17
July 9	78.3000	286.0	1 to 3.65	4.99
16	109.6000	226.0	1 to 2.06	8.86
29	166.0000	224.0	1 to 1.34	–
Aug. 8	124.0000	106.0	1 to 0.56	11.27
26	228.0000	121.0	1 to 0.53	11.52
Sept. 19	586.0000	346.0	1 to 0.59	11.45
19	169.0000	38.0	1 to 0.22	10.80
19	204.0000	50.0	1 to 0.25	13.15

The harvesting of the sugar-beet root begins when the outer leaves turn yellow and dry, which, in different seasons and localities, may vary from the fore part of September to the first of October. Pulling off the leaves, even in part, at any preceding stage of the growth of the plants, is seriously objected to, for it affects most decidedly the final yield of sugar. Nature, in its wonderful economy of matter and force, always provides for the continuance of species under the most advantageous conditions, storing up in some of the organs of plants, under the influence of a favorable summer temperature, a maximum of such compounds as will enable them to develop their organs for propagation almost independent of outside assistance. The flowers, and subsequently the seeds, draw upon the food accumulated in roots, stalks, and leaves; and the seeds themselves again store up an amount to enable the embryonic germ to provide itself with such organs as will fit it to fulfil its mission in the production of a new plant. Sugar is undeniably one of those substances which are required to support the beet-root plant in this last stage of growth.

The amount of sugar in the sugar-beet is largest when the root has just attained its ripeness; subsequently, it diminishes gradually in consequence of advancing growth. To preserve undiminished the maximum percentage of sugar till the time of manufacture is somewhat difficult. There is no such thing in nature as absolute rest. If it were practicable to keep the beet-root frozen from the beginning to the close of the manufacturing season, it might prove to be the most efficient mode, so far as the preservation of sugar is concerned. The manufacture of the sugar begins usually in the latter part of September; and the beet-roots are daily carried in such quantities from the fields as the factory can dispose of. Those varieties, like the Vilmorin beets, which do not keep well in the pits over winter, are first gathered and worked up. As soon as frost becomes imminent, all the roots are gathered after the removal of the leaves, which operation is carried on upon the fields. They are then buried in suitable pits without loss of time. The beets are raised out of the soil by means of forks, and the leaves cut off with sword-like knives about one-half to one inch from the root. To cut off the top of the beet-roots from those

which are to be kept over winter is disapproved of. The use of the plough in harvesting is also objectionable on account of frequent laceration of the roots.

The mature roots, after being freed from the leaves in the manner just described, are, with the adhering soil, laid carefully into shallow pits about six feet long by three feet wide, and from four to five feet in depth. These are finally covered with soil to protect them against frost. Small pits of the size just described are preferred; for they allow a better control of the temperature than large pits, which frequently suffer from an undesirable increase of heat, causing the growth of leaves, or degeneration by decay. The covering of soil is gradually increased in thickness with the advancing season, amounting usually to a final thickness of three feet, and this is sometimes rendered more efficient by a thin outer layer of stable-manure. To secure a uniform moderate temperature is the sole object of these proceedings, and pits beginning to heat are worked up without delay. The pits must be located upon very dry land on or near the beet-fields, and in such a position that no accumulation of water can injuriously affect them.

To give some idea about the changes which a good sugar-beet undergoes in the pits even under quite favorable circumstances, I insert the following statement of H. Rake. The same kind of beet-roots contained: —

In October, 1862: —

	Per cent.
Cellulose	3.49
Water	82.06
Cane-sugar	12.40
Grape-sugar	—
Mineral constituents	0.75
Albuminous and extractive substances	1.30
	100.00

In February, 1863: —

	Per cent.
Cellulose	2.52
Water	84.36
Cane-sugar	10.60
Grape-sugar	0.65
Mineral constituents	0.63
Albuminous and extractive substances	1.20
	100.00

Whenever the roots begin to rot, the sugar is lessened. The loss due to the sprouting of the leaves may amount to two per cent more than the preceding analysis states.

YIELD OF SUGAR-BEETS.

The numerous varieties of beets differ widely in regard to their annual yield, independent of the conditions of season, upon the same soil and under the same treatment. Whilst common mangels have been raised upon a suitable soil, in exceptional cases, at the rate of from ninety-four to one hundred and ten tons per acre, the sugar-beet never yields at any thing like such a rate. The following statement respecting the yield and amount of sugar obtained from three kinds of beets is quite interesting and suggestive regarding the important question, What kind of beet-roots are the most desirable for cultivation for the manufacture of sugar? —

Names.	Annual yield of Roots per acre.	Percentage of Sugar.	Amount of Sugar in the entire Root Crop.
	Pounds.		Pounds.
Metz (fodder-beet)	86,457	4.50	3,890
Imperial (sugar-beet)	59,613	10.51	6,265
Silesian White (sugar-beet)	52,787	13.64	7,200

These few numerical statements teach most decidedly, that mere quantity will not insure success for the beet-sugar interest. The cost of raising the sugar-beet is stated to be, in Germany, from forty-six to fifty dollars per acre; viz., —

For rent of land	$12 00
For fertilizer	20 00
For labor	14 00 to 18 00

In France from fifty-six to sixty dollars are chaı ged for the cultivation per acre. Both valuations include the work of putting the roots into the pits for winter keeping.[1]

[1] In Germany a hundred pounds of sugar-beet roots are taxed (eight sgr.) 19.44 cents (1869). In France every (fifty-two kilogrammes) 114.4 pounds of beet-sugar are taxed (thirteen francs and seventy-five centimes) $2.66. Every thousand kilogrammes, or twenty-two hundred pounds, of sugar-beet roots

The German farmer considers one ton of sugar-beet root worth to him, for feeding purposes, from four dollars to four dollars and fifty cents. He sells at from five dollars to five dollars and forty cents per ton to the beet-sugar manufacturer, besides which one-half of the refuse pulp is returned for feeding his stock. This refuse matter amounts to one-fifth of the weight of the roots, in case the pulp has passed through the press for the separation of the juice: its feeding value is considered equal to that of the fresh roots.

Not unfrequently, separate contracts are made for furnishing small beets not exceeding two pounds in weight. The sugar-beet cultivation usually becomes a prominent feature of agricultural industry in the vicinity of beet-sugar factories; for although the manufacturer of sugar is, as a general rule, to some extent at least, a producer of beets, he rarely limits himself to the amount of his own produce. He finds it profitable to purchase a certain quantity, if for no other reason, in order to be enabled to cultivate his own lands on a liberal system of rotation. He also frequently retains one-half of the press-cake, and other refuse resulting from the working of an additional amount of beet-roots, for stock-feeding and manuring purposes.

Recent extensive and careful experiments with the cultivation of the sugar-beet in the Connecticut-river Valley, and other parts of New England, have produced excellent results. From twenty to thirty tons of roots, containing in their juice as high as thirteen per cent of cane-sugar, have been obtained per acre, at a cost of from forty-five to fifty dollars for cultivation.

The roots sold, in many instances, at five and more dollars per ton. The farmers of Worcester County sold to the Maine Beet-Sugar Company the long ton of unwashed sugar-beets for five dollars at the nearest railroad depot, and received back the pulp at two dollars per ton.

yield on an average (fifty-two kilogrammes) 114.4 pounds of sugar in the form in which it is taxed. — WALKHOFF.

Recent reliable private communications coming from different sections of Germany state the expenses for the production of sugar-beet roots, when in the pits, in one case at forty-six dollars, and in another at fifty-nine dollars and a half per acre. Land rent in both cases was equal, and amounted to twelve dollars and a half per acre. Manure in the first case amounted to nearly one-half, in the second case to but one-third, of all expenses. The price of labor caused the difference.

YIELD OF JUICE.

The sugar-beet contains about eighty-two per cent of water; and eighty per cent of its juice may be obtained by subjecting the crushed beet to a powerful pressure. The relation of the power applied to the quantity of juice obtained may be inferred from the following statement of Walkhoff: —

By 50	pounds	of	pressure	to the	square	inch,	60	per cent.
80	"	"	"	"	"	"	64	"
400	"	"	"	"	"	"	75	"
750	"	"	"	"	"	"	80	"

The press-plates are made fourteen inches or more square; and twenty-four pounds of pulp for every hundred square inches of press surface is considered the best pròportion. The roots are usually changed into a pulp by circular saws fastened upon two hollow iron rollers running in opposite directions. Water is added (from fifteen to thirty per cent) while preparing the pulp, to reduce the amount of sugar left in the press-cakes. By means of this and numerous other devices, from eighty to eighty-seven per cent of the actual juice in the beet-roots is secured. The profitable addition of water is limited by the expense arising from the evaporation of a diluted juice.[1] The extra expense necessary to procure more than eighty per cent of the juice largely diminishes its value: nevertheless improved methods are constantly sought, and are doubtless attainable.

The press method and Roberts's[2] modification of warm and cold maceration of the fresh beets have apparently the warmest advocates.

The supply of labor, fuel, and water, the condition of the sugar market, &c., so far control the choice of apparatus and modes of operation, that little information could be gained from a general discussion without some detailed explanations. To the farmer, the vegetable refuse, as press-cake and like substances, is of prime importance; and the various modes of abstracting the juice from the beet-roots affect him only in

[1] One hundred pounds of coal are required for the evaporation of five hundred pounds of water in the course of beet-sugar manufacture.

[2] Roberts claims to secure ninety-four per cent of the juice by adding but fifteen per cent of water, and carrying on the first osmotic maceration at 80° to 87° Centigrade, and the remainder at a common temperature.

so far as the value of the refuse for feeding purposes is concerned. A comparison of the composition of the juices obtained by means of a powerful hydraulic press and by Roberts's maceration (or the dialytic mode), may aid in understanding this question, of which I shall have to treat somewhat more in detail hereafter: —

I.

Beet-juice procured by the aid of a hydraulic press contains: —

	Per cent.
Sugar	12.410
Potassa and soda compounds	0.458
Lime and magnesia	0.187
Nitrogenous substance	1.418
Non-nitrogenous organic substances	1.048

II.

Beet-juice procured by Roberts's diffusion apparatus with an addition of fifteen per cent of water, contains: —

	Per cent.
Sugar	11.580
Potassa and soda compounds	0.441
Lime and magnesia	1.191
Nitrogenous substance	0.791
Non-nitrogenous organic substances	0.983

YIELD OF SUGAR.

According to the mode of operation pursued, more or less sugar will be left with the cellular refuse mass. The residue of the hydraulic press contains from three and three-fifths to four and four-fifths per cent of sugar, or seventy-six hundredths per cent of the amount in the original sugar-beet; while Roberts's mode leaves but one-tenth to two-tenths per cent of sugar. Between these figures lie the quantities of sugar left by the application of other modes of operation. With the removal of the juice begins, consequently, the loss of sugar, which amounts, during the whole operation for its final separation, to about three and a half per cent under a good management of existing methods. To set down losses which occur in a branch of manufacture where peculiar skill so decidedly bears upon the final results, is no doubt quite arbitrary; but it is of interest to notice where they usually

occur, and to what degree they affect the final results in many instances. The following statement is presented as a fair one, and may serve the purpose just specified: —

One hundred parts of sugar-beet roots, under fair management, are liable to lose sugar as follows: —

	Per cent.
In the pits by degeneration	2.00
By change into grape-sugar	0.54
In process of filtration of the juice	0.14
In defecation and carbonization	0.21
In juice left in the press-cake	0.76
Total loss	3.65

One hundred parts of sugar existing in the beet-roots were, in one case, accounted for in the following way at the close of manufacture: —

	Per cent.
Crystallized sugar	62.46
Sugar left in the molasses	14.75
Lost during manufacture	22.79
Left in the press-cakes	11.48

Eight per cent of sugar from the beet is at present assumed to be the actual result of most factories with improved modes of operation and superior sets of apparatus: some factories claim even more. The importance of an increase in the yield of crystallized sugar may perhaps be best inferred from a case reported by W. Crookes, F.R.S., in his late publication on beet-sugar manufacture with reference to England. Mr. Baruchson, the beet-sugar manufacturer, is reported as stating that the factory cost £10,845; 150,000 pounds of sugar-beet root has been worked per day for five months; the expenses for labor amounted per year to £5,190; the total expenses per year had been £13,980; the total receipts per year were £20,470; the profits thus had amounted to £6,490, or twenty-four and three-fourths per cent on the first outlay; six and a half per cent of crystallized sugar had been the result. He further states that one-half per cent of increase of the yield of crystallized sugar would be equal to seven and a half per cent additional profits. Eight per cent of crystallized sugar from every hundred pounds of beet-roots worked would thus insure a profit of forty-eight per cent.

One hundred and fifty to one hundred and sixty pounds

of sugar per ton of two thousand pounds of roots are obtained in well-managed establishments: considering twenty tons the attainable yield of roots per acre, from twenty-eight hundred to three thousand pounds of sugar may be secured by established modes of manufacture.

In Germany the total expenses — the manufacturing cost and *the taxes on the beet-root* included — for the production of the sugar from one acre are stated to amount to from a hundred and thirty-two to a hundred and thirty-three dollars: in France, *where the sugar produced is taxed*, they amount to from a hundred and sixty to a hundred and sixty-two dollars per acre.

The expenses in the two countries are divided among the different operations in the following proportion: —

In Germany: —

	Per cent.
Manure	14.48
Cultivation of beets.	11.20
Taxes on sugar	34.82
Manufacturing expenses	39.40

In France: —

	Per cent.
Manure and cultivation of beets	24.40
Taxes on sugar	31.59
Manufacturing expenses	44.01

As the raising of a first-class sugar-beet on a large scale has been accomplished in our vicinity — see Flint's Twenty-seventh Annual Report for the year 1879, second part, pp. 47–52 — and elsewhere in our State, at a less cost, even in a first trial, than charged in Europe, it seems but reasonable to assume, that, in the absence of any home taxation, the manufacture of beet-sugar can be made in our State a remunerative *industrial* enterprise as soon as our farmers feel confident that the crop will pay them satisfactory returns.

BEET-SUGAR MOLASSES.

The molasses obtained from the sugar-beet is not fit for household consumption on account of its unpleasant saline taste. It is fermented, in most cases, for the production of alcohol, and rarely fed to live-stock, as its continued use, even in small quantities, is not considered safe, from its effect on the digestive organs.

A pound and four-fifths of molasses per day mixed with clover-hay or even straw has increased the yield of milk. Sometimes the molasses is mixed with caustic lime or the carbonate, and composted for manure, to furnish potassa, in particular, in the soil.

Average Composition of Beet-Sugar Molasses.

	Per cent.
Albuminous substances	9.2
Sugar	41.3
Other organic substances	16.1
Saline compounds	10.8
Water	22.6
	100.0

The saline constituents of course differ somewhat in every case, particularly as far as the lime compounds are concerned. The following analytical results (Trommer & Rode) may give some idea about their general character:—

I.

One hundred pounds of ash constituents of beet-sugar molasses contain of—

	Per cent.
Potassa	30.46
Soda	10.12
Lime	26.62
Sesquioxide of iron	0.04
Carbonic acid	19.07
Sulphuric acid	1.92
Silicic acid	0.06
Chlorine	10.03
	100.00

II.

Ash from molasses made upon the College Farm. One hundred parts of molasses equal 7.17 per cent of ash.

	Per cent.
Potassa	24.60
Soda	15.84
Lime	9.10
Magnesia	2.24
Sesquioxide of iron	1.44
Silicic acid	3.66
Moisture	5.27

The residual liquid left after the fermentation of the molasses is usually evaporated, and the solid mass subsequently calcined. The beet-sugar manufacture furnishes in this form quite a large quantity of valuable saline compounds for general industrial purposes. One hundred pounds of these calcined saline substances contain from forty-five to forty-eight per cent of soluble constituents of a composition more or less corresponding with the following figures: —

	Per cent.
Carbonate of potassa	27.60
Carbonate of soda	4.70
Chloride of potassium	6.75
Sulphate of potassa	6.75
	45.80

One single beet-sugar factory at Wagehäusel (Germany) sends every year two hundred thousand pounds of such potassa salts into market, which is mainly used for the manufacture of nitre. The molasses contains by far the largest portion of the soluble saline constituents of the sugar-beets, particularly the potassa compounds which must be returned to the soil directly or indirectly. The cheaper crude sulphate of potassa of Stassfurth is at present bought in exchange for the carbonate of potassa sold. Distilleries are frequently connected with sugar-beet manufactories.

THE CELLULAR RESIDUE OF THE BEET-ROOT.

(*Refuse Sugar-Beet Pulp.*)

The juice of the sugar-beet is secured in different ways, and the residue (pulp) differs according to the course pursued. The press-cakes resulting from the application of the hydraulic press, which is one of the main apparatus employed, are compact in consequence of packing the pulp into bags or coarse linen cloths before subjecting it to the press. One hundred pounds of beet-roots furnish from eighteen to twenty pounds of press-cakes, which consist, in case a very powerful press is used, of —

	Per cent.
Nitrogenous matter	1.336
Non-nitrogenous organic matter	23.354
Saline constituents.	1.180
Water	74.130
	100.000

These cakes are highly valued for feeding purposes. A hundred pounds of press-cakes are valued at twenty-nine and six-tenths cents when hay is worth twenty dollars per ton. The cellular residue of beets left after the abstraction of the juice by other modes is, as a general rule, less valuable, on account, mainly, of the presence of a larger amount of water, and thus a smaller amount of solid organic matter. For instance, the residue, after the treatment with centrifugal apparatus and the subsequent displacement process, is considered worth but sixteen and nine-tenths cents per hundred pounds. By applying the centrifugal apparatus for the separation of the juice, about thirty per cent of refuse pulp is obtained, which consists (approximately) in one hundred parts of —

	Per cent.
Nitrogenous organic matter	1.030
Non-nitrogenous organic matter	14.710
Saline constituents	1.660
Water	82.600
	100.000

The refuse pulp obtained by hot maceration of dried beet-roots is held at from twenty-four to twenty-five cents per hundred pounds; while that obtained by a maceration of the fresh beet-roots after Roberts's improved diffusion method (free from an excess of lime) is valued at from seven and two-tenths to nine and one-tenth cents per hundred pounds. The last-named residue contains but from five and five-tenths to six and nine-tenths per cent of dry substance; while common press-cakes contain twenty-five per cent. Roberts's mode of operation leaves about seventy pounds of cellular residuum for every hundred pounds of beet, which contains, as stated previously, more nitrogenous matter in proportion to dry substance, but less sugar, than common press-cakes.

The diffusion mode is applied in the beet-sugar factory at Portland, Me. The feeding value of the refuse pulp depends largely on the state of moisture. In case of an equal state of dryness, the refuse from the diffusion system is the most valuable, on account of from forty to fifty per cent more of nitrogenous matter than in the mode above described. Without a previous pressing, the refuse is worth

but one-fourth of the price of the press-cake from the first described mode of securing the juice from the pulp. In case of well-pressed refuse beet-root pulp (containing twenty-five per cent of dry matter), the following mode of feeding to stock is customary:—

For Fattening Cattle and for Milch Cows.

	Pounds.
Beet-pulp	100
Hay	50
Chopped straw	100
Bran or oil-cake	20

For Horses.

	Pounds.
Beet-pulp	100
Hay	50
Oats	50
Bran	20

For Sheep.

	Pounds.
Beet-pulp	100
Hay	50
Bran	20

Twenty tons of beet-roots furnish four tons of well pressed refuse pulp, which, at five dollars per ton, amounts to twenty dollars per acre of sugar-beets. One hundred pounds of common press-cakes contain twenty-five per cent of dry substance; and, as the dry substance of any article of vegetable food is known to furnish one and three-fourth times its weight in common stable-manure, thirty-five hundred pounds of manure will be obtained from one acre of sugar-beets.

The fodder value of press-cakes resulting from the operation with the hydraulic press without subsequent maceration is equal to the same weight of sugar-beet roots. They are even preferred to the latter, since they become more digestible, and acquire, after being buried in pits, in consequence of slow fermentation, a slightly acidulated taste. Cattle then eat them greedily, and thrive upon them, particularly in case they are fed in connection with a proper quantity of oil-cake, bran, hay, or barley-straw, &c., to replace the po-

tassa compounds and the phosphates which the juice has carried off.

The preservation of the press-cakes is easily accomplished. They are packed closely into the empty beet-root pits, or into brick chambers, being frequently interlaid with a small quantity of chopped straw, and finally tightly covered with soil. The fermented mass resulting from this operation keeps in an excellent state of preservation for six to seven months.

PRODUCE OF LEAVES.

The leaves amount, at the time of the harvesting of the roots, to about one-fourth of the weight of the latter: calculating as previously, six thousand pounds of leaves would result from an acre. The leaves are separated upon the fields, and subsequently, in their green state, ploughed under deeply, or they are fed either fresh, or in a preserved state.

The manuring effects of the beet-leaves is very great, since they contain in their fresh state more potassa, more phosphoric acid, and more nitrogenous substances, than an equal weight of roots. Their ash percentage is also larger than that of the beet-roots, consisting mainly of alkalies and alkaline earths. Almost one-third of all the potassa, one-half of the phosphoric acid, and two-fifths of the whole amount of nitrogenous substances of the entire sugar-beet crop, is contained in the leaves. As they can be fed in small quantity only, in their fresh state, they are salted down in pits.

The pits used for this purpose ought to be in a dry locality, and dug to a depth of from five to six feet. The bottom is covered, from two to three inches thick, with a layer of chopped straw of oats, rye, or wheat; then a layer, from four to five inches thick, of fresh beet-leaves mixed with one-quarter of one per cent of common salt, is put on and trodden down, and these alternations continued until the pit is not only filled, but raised from two to three feet above the ground; and then a layer of two feet of soil is added as covering. In the same proportion, as the mass shrinks in consequence of fermentation, new soil is added to keep the covering above the level of the surrounding ground as protection from the rain.

The leaves in the pits begin soon to ferment, and to discharge moisture, which the straw absorbs. They retain a strong smell until January, when they turn sweet by degrees, and are on that account freely eaten by cattle. Sixty pounds of fresh green leaves produce forty pounds of preserved leaf-mass, one acre furnishing thus about thirty-nine hundred pounds of such food, which, taking a hundred pounds of hay worth one dollar, is valued at sixteen and three-tenths cents per hundred pounds. One acre would thus produce in food derived from the leaves six dollars and thirty-five cents. Fresh leaves have eleven and ninety-nine hundredths per cent of dry substance; preserved leaves contain fifteen per cent: the leaves of one acre of sugar-beet root contain therefore five hundred and eighty-five pounds of dry substance, which, multiplied by one and three-fourths, gives about a thousand pounds of manure from this source of food. The leaves are never fed by themselves.

Grouven recommends the following composition of food for every thousand pounds of live weight per day: forty to fifty pounds of preserved leaf-mass, forty pounds press-cakes, three pounds of oil-cake, with six pounds of hay. Preserved beet-leaves, it appears from experiments of Tod, increase the production of milk in quality and quantity; whilst press-cakes, if exclusively used, reduce its quantity decidedly. A mixed food of a hundred pounds of press-cakes with seventy-five pounds of preserved leaves, produced, for every hundred pounds of leaves fed, an increase of twenty-four pounds and a half of milk per day as compared with a corresponding feeding of press-cakes alone.

The value of press-cakes and preserved leaves for the support of live-stock, particularly during a period when food as a general rule becomes scarce, and thus expensive, must be quite apparent, especially when we consider further that every ton of sugar-beets raised furnishes four hundred pounds of press-cakes and four hundred pounds of fresh leaves, and that an ordinary factory consumes from forty to fifty tons of beet-roots per day during five months.

In cases where stock feeding is no part of the enterprise, or where plenty of other kinds of food is at hand, the leaves while still green are ploughed under. The part which the beet-leaves perform in the absorption of mineral constituents

from the soil may be seen from the following analytical statement: —

A fair average crop of sugar-beets abstracts per acre, —

By Roots and Leaves.

	Pounds.
Phosphoric acid	35.00
Potassa	164.00
Lime and magnesia	63.50
Silica	15.09

By Roots Alone.

	Pounds.
Phosphoric acid	25.0
Potassa	126.0
Lime and magnesia	32.0
Silica	6.5

Returned in Form of Leaves.

	Pounds.
Phosphoric acid	10.0
Potassa	38.0
Lime and magnesia	31.5
Silica	9.4

The recent appearance of the European beet-sugar for refining purposes in the sugar-markets of England, as well as in our own country, furnishes the proof that the beet-sugar industry has reached a state of development which encourages its patrons to meet the cane-sugar industry in its strongholds, in spite of a burdensome home taxation. This circumstance, in connection with the recent successful introduction of the beet-sugar manufacture at Portland, Me., has tended largely to create a more general interest in the subject under consideration. A satisfactory solution of the industrial problem involved is conceded; and it becomes more generally understood that the future prospect of the beet-sugar manufacture rests largely with the decision of our farmers, whether they are willing to unite with our capitalists in sharing the responsibility in the new industry.

C. A. Goessmann.

The committee appointed to report a plan for experiments to be recommended to the societies the present year, with

the understanding that it would be likely to be required in future, submitted the following: —

To the Officers and Members of the —— Agricultural Society, receiving the bounty of the State.

The Massachusetts State Board of Agriculture, believing that a series of thoroughly conducted agricultural experiments under the management of each society will be of great value to all the farmers of the State, hereby directs each of the societies, after the present year, to offer the sum of not less than fifty dollars in premiums for the most successful and satisfactory experiments on some one (or more) of the following subjects, under the conditions annexed, to be awarded by a committee appointed by the society for that purpose. The officers of each society shall, as soon as may be, notify the secretary of this Board what experiments will be tried, and shall in its printed Transactions furnish a detailed report of the same to the Board.

EXPERIMENTS TO ASCERTAIN THE RELATIVE VALUE OF LEVEL OR HILL CULTURE.

For the best experiment, fifteen dollars; next best, ten dollars.

Competitors for these prizes shall select one half-acre of land of as equal quality as possible, and divide it into two equal parts: in one part the land shall be kept perfectly level, and in the other shall be hilled in the usual way at the time of hoeing.[1] When the crop is harvested the two parts shall be kept separate, and accurately weighed, and a detailed report of the result given, including the difference in the cost of cultivation, if any.

EXPERIMENT TO ASCERTAIN THE VALUE OF SKIM-MILK FOR SWINE.

For the best experiment, fifteen dollars; next best, ten dollars.

The period which this experiment shall cover to be four months.

Two pigs shall be selected as nearly alike as possible, of

[1] In all other respects the crop and cultivation shall be the same, and shall have the same number of hills or drills.

the same breed, age, and size, and shall be weighed before the experiment commences. The feed of the two shall be exactly alike, with the exception that the feed of one shall be thinned with skim-milk and the other with water. After the expiration of two months, the pigs shall be weighed, and a record made of the weight, together with a description of the feed given, the amount, and the value. A change shall now be required, so that the pig that has had milk shall have water, and the one that has had water shall have milk. At the end of four months the pigs shall be again weighed, and a record made as before, and a statement shall be made containing in detail the results of the four months' trial.

EXPERIMENT TO ASCERTAIN THE COST OF MILK.

For the best experiment to ascertain the cost of milk, thirty dollars; next best, twenty dollars.

The experiment should be continued during the period of one year.

Competitors shall be required to keep an exact account of all food eaten by the cows when not at pasture; to give a statement of the kind, quality, and value of the same. When the cows are at pasture, a separate account, as above, shall be given of all food consumed by the cows other than pasture-feed. The number of days that the cows are at pasture must be given, and also a description of the pasture, with the cost of pasturage consumed by each cow.

The milk shall be accurately weighed, and a statement of the product of each three months in the year given. A statement shall also be made of the number of days the calf is permitted to take a portion or all of the milk, the kind, quality, and value of feed given each calf, and the weight and value of each when taken away from the cow. The breed of each cow shall be given, together with the weight, age, and value.

For the best experiment in ascertaining the most profitable method of seeding for potatoes, fifteen dollars; second best, ten dollars.

The experiment shall include the planting one eye in a place, two eyes, also one-half or a whole potato; also to show which end of the potato is best for seed, the size of piece and number of eyes in each piece being the same. The results

to be shown by weighing the whole crop grown from each method of seeding, all other conditions of cultivation being equal.

BENJAMIN P. WARE,
AUGUSTUS T. PERKINS, } *Committee.*
EDMUND HERSEY,

Messrs. Moore, Damon, Bowditch, Taft, and the Secretary were constituted a committee of arrangements for the public meeting of the Board at Southborough.

The several papers which had been read, discussed, and laid over, were taken from the table, read a second time by their titles, and accepted.

Voted, That an executive committee of five be appointed by the Chair: Messrs. Wilder, Hadwen, Hersey, Perkins, and Ware.

Voted That all unfinished and any new business that may be presented be referred to the Executive Committee with full power.

The Board then adjourned.

Many of the papers presented in the foregoing pages will be found to be of great value and of the highest interest and importance. They seem to leave little to be said to extend the limits, or to add to the completeness, of this Report. They embody the most recent information of a practical and scientific character upon a great variety of topics which enter into and affect the every-day life of every farmer in the Commonwealth. The dairy must be regarded as the great leading specialty of New England. The papers, lectures, and discussions devoted to that subject, are especially full and suggestive, comprehending all its details relating to the selection, breeding, feeding, and management of stock, and the processes most recently introduced in the methods of handling milk, and the manufacture of butter and cheese.

The papers containing the details and results of intelligent farm practice and experience will constitute a safe and

valuable guide to many a young farmer, who is, perhaps, groping along blindly, searching for new light, and ready to accept the results of the experience of older men who have passed through similar trials, and met and overcome similar obstacles.

The valuable scientific contributions to our knowledge of the relative value of feeding substances, and the effects of fertilization upon the quality of our cultivated fruits, open up a new field of study, which promises to be of the highest importance to every intelligent cultivator and to the community at large; while the report of the inspector of fertilizers will constitute the best possible guide to every purchaser of these articles, and furnish a safe and trustworthy basis of innumerable business transactions. Using as we now are more than a million dollars' worth of concentrated commercial fertilizers every year, such a guide is of the highest value, and, indeed, absolutely indispensable, to every farmer who aims to make his purchases intelligently.

The paper upon the sugar-beet and the manufacture of beet-sugar will be found to be very timely, and to supply a want now very generally felt in the community for the latest and most trustworthy information upon that subject. The history of the beet-sugar industry in Europe ought to be carefully studied and mastered by us before embarking largely in it here. The experience of many years there has worked out important problems, which it will not do for us to ignore. A full knowledge of the obstacles which they have met and successfully overcome will be the surest guide for us. We need to recognize and appreciate all the conditions requisite to success, which have been established in older countries only after the expenditure and the loss of vast amounts of capital and the experience of untold individual disappointment and disaster. Such a knowledge of the results obtained there during more than half a century of experimenting and scientific investigation will enable us to start with an immense advantage in our favor, and to avoid innumerable mistakes which must be regarded as inevitable incidents of all new enterprises.

To raise roots for stock, whether it be the sugar-beet, the mangold, the ruta-baga, or some other, is one thing: to raise the sugar-beet intelligently for the economical manufacture

of sugar is quite another. We can raise sugar-beets in all parts of New England, and we can extract more or less sugar from them, no matter where, or under what conditions, they are grown; but, when it comes to raising them for the express purpose of the manufacture of sugar as a profitable commercial enterprise, we cannot follow the hap-hazard methods which may answer very well in raising them simply as food for cattle. We are confined to comparatively narrow limits as to many details to be observed in the kind and quantity of fertilizers to be used, the size of beets most economical for the manufacture of sugar, the necessity for a long rotation, the intelligent selection of seed and of varieties with reference to the amount of saccharine matter, in which they differ so widely, and a thousand other conditions with which we are not as yet sufficiently familiar.

Perhaps there can be no more striking illustration of the necessity of extreme care than the results of the interesting investigations as to the difference in saccharine matter to be found in large and small sized beets, as presented on p. 384. If such a marked difference in the relative amount of sugar they contain is found to exist uniformly, as we have every reason to believe it does, and as experiments in Europe seem to show, it is very easy to see that the question of success or failure, when it comes to a business enterprise, in the long-run, might turn upon this point. Again: see the very marked difference in saccharine matter resulting from the use of unfermented stable-manures, and old composts or concentrated fertilizers, in the statements of sugar-beet growers, as presented in Part Second of this Report, pp. 48–52. The difference is so great, that it is apparent that the question of a fair profit, or a certain and positive loss, would be likely to turn upon this point, if the beets were to be used for the extraction and the manufacture of sugar.

I have no doubt the time will come when we shall do vastly more than we are doing now to supply our own wants in this respect, and when we shall become more independent of foreign importations of an article of such prime necessity. There are many portions of the country where the conditions of soil and climate are eminently suited to the development of this industry, and where it can be established and pursued, not only with profit to the manufacturer, but with

immense advantage to the agriculture of the country. Meantime let us make haste slowly, study and experiment, so that every step will be one of real and permanent progress.

Official returns show that the farming interests of the State are gradually and steadily advancing. The number of cows has increased more than seven thousand, the number of sheep, more than four thousand, and the number of horses, more than three thousand, during the past year. There has never been a time in twenty-five years when the spirit of improvement has been so great or so manifest as during the past. There has never been a time when so many or so well-attended farmer's institutes have been held, when the spirit of inquiry and interest has been so great or so general. It has been a period of agricultural revival; may it go on till our resources are fully developed, and the practical pursuit of farming is placed on a level with every other branch of applied chemistry!

CHARLES L. FLINT,

Secretary of the State Board of Agriculture.

BOSTON, January, 1880.

THE

FINANCES OF THE SOCIETIES.

FINANCES OF THE SOCIETIES.

SOCIETIES.	Amount received from the Commonwealth.	Income from permanent fund.	New members and donations.	All other sources.	Receipts for the year.	Premiums offered.	Premiums and gratuities paid.	Current expenses for year, not includ'g premiums and gratuities.	Disbursements for the year.	Indebtedness.	Value of real estate.	Value of personal estate.	Permanent fund.
Massachusetts . .	-	$5,416 03	-	$1,169 00	$6,585 03	-	-	$228 51	$1,883 88	-	-	$79,967 80	-
Essex . . .	$600 00	1,491 00	$78 00	1,851 88	4,020 93	$3,037 00	$1,616 00	2,142 12	3,758 12	-	$6,000 00	15,000 00	$21,000 00
Middlesex . .	600 00	-	64 00	2,764 94	3,428 94	1,859 50	688 47	2,233 60	3,317 31	$16,500 00	20,000 00	-	3,500 00
Middlesex North .	600 00	375 00	71 00	1,162 34	2,208 34	1,263 00	669 75	1,221 69	1,891 44	1,500 00	20,000 00	-	18,500 00
Middlesex South .	600 00	75 00	87 00	-	1,648 60	1,062 50	1,090 00	516 85	1,648 60	11,000 00	18,000 00	-	7,000 00
Worcester West .	600 00	-	32 00	2,973 87	3,605 87	1,509 25	1,202 00	1,080 05	3,310 05	2,054 18	11,600 00	750 00	10,295 82
Worcester North .	600 00	-	590 53	2,034 49	2,635 02	758 00	758 00	1,552 58	2,356 80	11,600 00	16,000 00	456 86	4,856 86
Worcester No.-West,	600 00	-	77 50	2,761 70	3,439 20	1,756 50	1,298 06	1,569 43	2,867 49	7,672 47	12,500 00	1,334 79	6,162 32
Worcester South .	600 00	1,000 00	94 00	2,984 77	3,678 77	1,604 50	1,235 35	883 90	3,847 65	500 00	12,000 00	1,000 00	12,500 00
Worcester So.-East .	600 00	-	-	1,635 89	2,235 89	1,501 00	103 71	2,059 37	2,163 08	10,373 00	7,500 00	1,000 00	-
Hampshire, Franklin, and Hampden	600 00	293 96	300 00	2,297 59	2,861 55	1,138 25	615 38	1,405 27	2,702 06	7,786 01	7,800 00	289 49	303 48
Hampshire . .	600 00	-	148 05	730 51	1,481 53	751 50	622 25	635 69	1,257 94	906 70	4,100 00	150 00	3,343 30
Highland . . .	600 00	38 40	42 00	686 40	1,366 40	837 30	666 25	395 73	1,061 98	-	3,000 00	700 00	3,700 00
Hampden . . .	600 00	-	30 00	153 15	783 15	1,476 55	462 95	311 23	774 18	8,500 00	100 00	-	-
Hampden East .	600 00	-	159 84	746 42	1,506 26	1,096 00	771 95	590 88	1,362 83	-	5,000 00	-	5,000 00
Union . . .	600 00	-	132 50	1,239 74	1,972 24	1,098 25	793 66	736 64	1,530 30	64 02	5,000 00	1,427 57	6,363 55
Franklin . . .	600 00	120 00	45 00	1,146 68	1,911 68	912 75	742 50	1,086 27	1,828 77	1,600 00	10,000 00	1,600 00	10,000 00
Deerfield Valley .	600 00	-	177 37	868 48	1,645 85	767 00	624 20	621 65	1,645 85	1,700 00	8,070 00	99 84	6,469 84
Berkshire . . .	600 00	507 51	331 00	3,385 60	4,824 11	2,482 00	2,350 00	2,175 57	4,525 57	800 00	6,000 00	800 00	6,000 00
Hoosac Valley . .	-	-	238 00	2,555 80	2,793 80	1,598 00	1,269 25	1,059 57	2,759 07	5,975 00	12,500 00	1,460 78	7,985 78

Housatonic . .	600 00	-	164 00	4,322 15	5,086 15	3,054 00	2,791 00	2,769 84	4,821 58	-	8,000 00	1,250 00	9,250 00
Hingham . . .	600 00	-	160 45	3,560 09	4,320 54	1,387 25	659 65	3,768 73	4,428 38	3,500 00	34,600 00	4,600 00	35,700 00
Bristol . . .	600 00	-	295 65	8,002 84	8,913 49	4,267 00	4,290 50	4,221 33	8,858 28	11,500 00	50,000 00	300 00	38,800 00
Plymouth . . .	600 00	226 29	2,980 00	5,574 17	9,380 46	2,995 00	2,530 78	1,304 66	9,190 43	7,809 97	40,000 00	2,000 00	34,190 21
Marshfield . .	600 00	-	75 00	2,018 15	2,693 15	1,063 00	565 00	1,533 41	2,098 41	3,800 00	11,856 92	1,592 78	9,649 70
Barnstable . .	600 00	68 00	178 70	922 94	1,769 64	1,068 00	798 85	781 02	1,579 87	600 00	6,000 00	500 00	5,900 00
Nantucket . .	600 00	15 00	59 75	469 56	1,144 31	1,163 00	587 60	1,071 44	1,659 04	525 00	3,325 00	213 26	3,013 26
Martha's Vineyard .	600 00	118 50	22 00	589 33	1,329 83	833 25	767 45	458 83	1,226 28	200 00	2,000 00	2,000 00	3,800 00
Totals . .	$15,600 00	$9,744 69	$6,633 34	$58,608 48	$89,270 73	$42,339 35	$30,570 56	$38,415 86	$80,355 24	$106,466 35	$340,951 92	$115,493 17	$273,284 12

PERMANENT FUND, — HOW INVESTED.

MASSACHUSETTS. — In bank-stock, railroad-stock, railroad-bonds, loans secured by real-estate mortgage, bonds secured by real-estate mortgage, and funds in Massachusetts Hospital Life Insurance Company.

ESSEX. — In bank-stock, railroad-bonds, farm, library, cattle-pens, and fixtures.

MIDDLESEX. — In land and buildings.

MIDDLESEX NORTH. — In land and buildings.

MIDDLESEX SOUTH. — In grounds, buildings, stalls, pens, track, &c.

WORCESTER WEST. — In real estate and fixtures.

WORCESTER NORTH. — In real estate and buildings.

WORCESTER NORTH-WEST. — In grounds and buildings, including track and fences.

WORCESTER SOUTH. — In hall, land, track, and fixtures.

WORCESTER SOUTH-EAST. — In real estate and personal property.

HAMPSHIRE, FRANKLIN, AND HAMPDEN. — In real estate and personal property.

HAMPSHIRE. — In real estate.

HIGHLAND. — In notes and mortgage on real estate.

HAMPDEN EAST. — In fair grounds and buildings.

UNION. — In fair-grounds, hall, barn, scales, furniture, and cash.

FRANKLIN. — In Franklin County National Bank of Greenfield.

DEERFIELD VALLEY. — In real estate.

BERKSHIRE. — In real estate.

HOOSAC VALLEY. — In real estate and personal property.

HOUSATONIC. — In real estate, personal, notes of members, and cash.

HINGHAM. — In real estate, buildings, furniture, and fixtures.

BRISTOL. — In real estate and personal property.

PLYMOUTH. — In real estate, furniture, and fixtures.

MARSHFIELD. — In real estate and personal property.

BARNSTABLE. — In United States bonds, land, and buildings.

NANTUCKET. — In grounds, hall, furniture, fixtures, and cash.

MARTHA'S VINEYARD. — In hall, yard and notes of members.

ANALYSIS OF PREMIUMS AND GRATUITIES AWARDED.

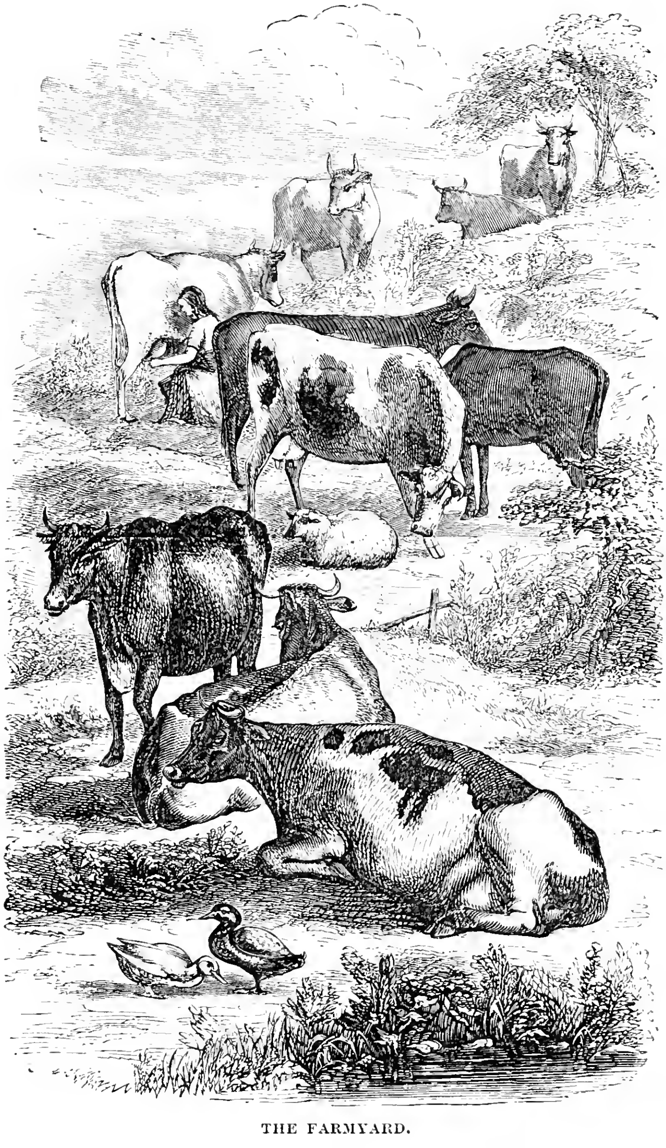
SOCIETIES.	Total am't offered for management and improvement of farms, orchards, &c.	Total amount paid for management and improvement of farms, orchards, &c.	For neat and dairy stock.	For horses.	For all other farm-stock.	Total amount offered for live-stock.	Total amount paid out for live-stock.	For cereals and seed.	For roots and vegetables.	Total amount offered for grain and root crops.	Total amount paid out for grain and root crops.	For fruits, flowers, &c.	For dairy-products.	For bread, honey, and preserved fruits, &c.	Total amount paid out under the head of farm-products.
Massachusetts .	-	-	$78 15	-	$1,177 22	-	$1,255 37	-	-	-	-	-	$100 00	-	$100 00
Essex . . .	$327 00	$132 00	295 00	$261 00	126 00	$1,113 00	560 00	$10 00	$224 00	$170 00	$60 00	$346 00	53 00	$17 00	650 00
Middlesex . .	152 00	23 00	178 00	123 00	189 50	712 00	490 50	7 00	99 50	161 00	106 50	269 00	12 00	56 00	443 50
Middlesex North,	16 00	12 00	226 00	147 00	99 25	775 00	352 50	14 00	79 00	141 00	94 75	191 25	16 00	61 00	316 75
Middlesex South,	134 00	59 00	154 00	103 00	192 50	439 50	439 50	10 00	69 00	134 00	10 00	100 00	9 00	35 00	233 00
Worcester West,	95 00	26 00	350 00	157 00	89 00	685 00	576 50	9 00	16 00	77 00	23 25	57 75	31 00	10 00	117 50
Worcester North,	-	-	136 50	116 00	58 50	314 00	303 50	21 50	25 75	66 50	41 75	75 50	25 00	15 75	158 00
Worcester N.-W.	24 00	20 67	274 00	116 00	187 50	831 50	557 63	20 00	18 00	50 00	32 33	37 00	20 00	6 00	86 91
Worcester South,	180 75	45 00	233 00	610 00	158 60	1,161 00	1,001 60	11 00	10 75	111 50	20 50	45 00	27 00	42 50	187 00
Worcester S.-E. .	244 00	16 80	340 00	121 00	262 75	898 50	83 87	13 00	63 50	166 00	5 93	42 50	19 00	9 90	11 95
Hampshire, Franklin, and Hampden,	20 00	-	182 00	113 00	145 00	573 00	386 50	2 50	122 00	202 50	103 50	81 75	13 00	14 00	233 45
Hampshire . .	-	-	82 00	101 00	125 50	400 00	308 50	19 50	44 00	71 00	63 50	71 00	12 50	23 50	170 50
Highland . .	56 00	54 00	190 25	117 00	87 00	521 75	394 25	2 00	2 50	11 00	4 50	20 25	10 50	14 15	49 40
Hampden . .	127 00	15 00	180 00	89 00	73 00	777 00	294 00	15 00	14 25	52 85	28 13	114 95	10 00	11 00	129 29

Hampden East .	145 00	21 00	201 00	105 00	83 00	459 00	389 00	13 00	12 75	77 00	25 75	42 00	14 00	11 50	98 25
Union . . .	17 00	3 00	140 00	128 00	182 25	606 00	437 25	27 00	34 25	76 50	51 30	25 50	14 75	5 90	102 71
Franklin . .	54 00	-	144 00	93 00	235 25	500 00	457 75	13 50	33 50	76 00	28 25	114 75	19 00	24 50	209 50
Deerfield Valley,	50 00	5 00	108 50	78 00	248 25	432 00	356 75	38 00	21 75	75 00	59 65	36 40	9 25	24 25	139 65
Berkshire . .	113 00	104 00	406 00	186 00	254 50	949 50	846 50	192 00	164 00	353 00	356 00	95 50	37 00	44 00	532 50
Hoosac Valley .	60 00	54 00	129 00	159 00	223 50	637 00	506 50	140 00	89 25	227 00	218 75	85 25	43 00	45 50	403 50
Housatonic . .	136 00	114 00	403 00	200 00	371 00	1,101 00	974 00	432 00	91 00	545 00	523 00	170 00	68 00	59 00	820 00
Hingham . .	71 00	13 00	185 50	43 00	120 20	690 75	348 70	-	39 05	102 50	31 55	104 30	15 00	20 35	178 70
Bristol . .	121 00	12 00	540 00	162 00	261 00	1,860 50	963 00	42 00	81 25	271 00	123 25	168 50	46 00	23 75	731 25
Plymouth . .	-	160 00	481 20	194 00	147 68	967 00	822 88	104 00	77 00	246 00	181 00	145 12	42 00	30 25	397 00
Marshfield . .	58 00	33 00	115 00	61 50	78 00	359 50	223 00	-	76 50	98 00	-	76 90	14 00	25 55	290 95
Barnstable . .	161 00	64 00	150 50	44 00	116 75	333 00	311 25	14 00	66 75	197 00	80 75	76 25	19 00	32 50	208 50
Nantucket . .	98 00	29 00	148 50	44 00	72 50	591 00	265 00	5 00	40 00	147 00	45 00	46 50	10 00	14 00	115 40
Martha's Viney'd,	57 00	8 00	209 25	44 50	106 35	373 75	346 38	62 50	71 83	134 00	122 85	66 20	11 50	29 10	241 13
Totals . .	$2,516 75	$1,023 47	$6,260 35	$3,716 00	$5,481 55	$19,061 25	$14,252 08	$1,237 50	$1,677 13	$4,039 35	$2,441 74	$2,705 12	$720 50	$705 95	$7,356 29

Analysis of Premiums and Gratuities Awarded. — *Concluded.*

MISCELLANEOUS.

SOCIETIES.	For agricultural implements.	Offered for raising forest-trees.	For experiments on manures.	Amount awarded for objects strictly agricultural not already specified.	Amount awarded and paid out for trotting horses.	For objects not strictly agricultural: domestic manufactures, &c.	Number of persons who received premiums and gratuities.
Massachusetts . .	-	-	-	$300 00	-	-	-
Essex	$43 00	$30 00	$25 00	-	-	$210 00	-
Middlesex . . .	51 00	50 00	-	-	$820 00	119 50	142
Middlesex North . .	-	-	-	-	-	-	194
Middlesex South . .	5 00	30 00	-	15 00	310 00	52 00	406
Worcester West . .	12 00	30 00	10 00	-	425 00	70 00	227
Worcester North . .	32 00	25 00	-	4 00	80 00	173 10	216
Worcester North-West,	8 00	30 00	-	-	540 00	118 70	188
Worcester South . .	-	35 00	-	-	440 00	18 00	181
Worcester South-East .	16 50	30 00	-	-	430 00	133 90	243
Hampshire, Franklin, and Hampden .	8 50	20 00	-	-	351 00	32 00	181
Hampshire . . .	7 00	16 00	-	-	220 00	116 25	128
Highland . . .	3 00	-	-	-	46 00	119 60	212
Hampden . . .	30 00	30 00	15 00	-	-	23 50	94
Hampden East . .	20 00	25 00	60 00	-	195 00	53 70	142
Union	2 75	-	-	23 65	142 00	82 90	197
Franklin . . .	Diplomas.	10 00	5 00	-	-	87 75	323
Deerfield Valley . .	-	-	-	13 00	-	109 80	400
Berkshire . . .	57 00	-	-	-	970 00	340 00	552
Hoosac Valley . .	20 00	-	10 00	33 50	555 00	252 75	315
Housatonic . . .	-	-	-	-	560 00	323 00	738
Hingham . . .	-	50 00	-	10 00	-	109 25	379
Bristol	50 00	23 00	60 00	-	1,566 00	386 85	538
Plymouth . . .	16 00	60 00	-	18 00	780 00	216 70	461
Marshfield . . .	15 00	50 00	-	5 00	149 00	149 30	556
Barnstable . . .	5 00	7 00	12 00	-	80 00	130 10	389
Nantucket . . .	-	13 00	16 00	-	-	165 10	193
Martha's Vineyard .	-	11 00	10 00	-	-	174 92	265
Totals . . .	$401 75	$575 00	$223 00	$422 15	$8,659 00	$3,768 67	7,860



THE FARMYARD.

ABSTRACT OF RETURNS

OF THE

AGRICULTURAL SOCIETIES

OF

MASSACHUSETTS.

1879.

EDITED BY

CHARLES L. FLINT,

Secretary of the State Board of Agriculture.

BOSTON:

Rand, Avery, & Co., Printers to the Commonwealth,

117 Franklin Street.

1880.

OFFICERS OF THE AGRICULTURAL SOCIETIES, 1880.

MASSACHUSETTS.

President—THOMAS MOTLEY of Jamaica Plain.
Secretary—EDWARD N. PERKINS of Boston.

ESSEX.

President—BENJAMIN P. WARE of Marblehead.
Secretary—CHARLES P. PRESTON of Danvers.

MIDDLESEX.

President—JOHN CUMMINGS of Woburn.
Secretary—BENJAMIN W. BROWN of Concord.

MIDDLESEX SOUTH.

President—LEONARD WINCH of Natick.
Secretary—R. GODDARD of Southborough.

MIDDLESEX NORTH.

President—A. C. VARNUM of Lowell.
Secretary—E. T. ROWELL of Lowell.

WORCESTER.

President—CHARLES B. PRATT of Worcester.
Secretary—G. H. ESTABROOK of Worcester.

WORCESTER WEST.

President—E. C. FARNSWORTH of Templeton.
Secretary—HENRY J. SHATTUCK of Barre.

WORCESTER NORTH.

President—GEORGE JEWETT of Fitchburg.
Secretary—WALTER A. DAVIS of Fitchburg.

WORCESTER NORTH-WEST.

President—JAMES W. BROOKS of Petersham.
Secretary—J. F. WHITCOMB of Athol.

WORCESTER SOUTH.

President — JOHN O. McKINSTRY of Southbridge.
Secretary — AMASA C. MORSE of Sturbridge.

WORCESTER SOUTH-EAST.

President — GEORGE S. BALL of Upton.
Secretary — CHARLES J. THOMPSON of Milford.

HAMPSHIRE, FRANKLIN, AND HAMPDEN.

President — H. C. HASKELL of Deerfield.
Secretary — L. C. FERRY of Northampton.

HAMPSHIRE.

President — W. L. WARNER of Sunderland.
Secretary — W. L. BOUTWELL of Leverett.

HIGHLAND.

President — HARLOW LOVELAND of Middlefield.
Secretary — JONATHAN McELWAIN of Middlefield.

HAMPDEN.

President — C. L. BUELL of Ludlow.
Secretary — J. N. BAGG of West Springfield.

HAMPDEN EAST.

President — WILLIAM HOLBROOK of Palmer.
Secretary — O. P. ALLEN of Palmer.

UNION.

President — S. A. BARTHOLOMEW of Blandford.
Secretary — ENOS W. BOISE of Blandford.

FRANKLIN.

President — JAMES S. GRINNELL of Greenfield.
Secretary — HENRY G. NIMS of Greenfield.

DEERFIELD VALLEY.

President — C. B. MAYHEW of Charlemont.
Secretary — M. M. MANTOR of Charlemont.

BERKSHIRE.

President — SIMON H. WHITE of Hinsdale.
Secretary — WILLIAM H. MURRAY of Pittsfield.

HOOSAC VALLEY.

President — J. K. HOUGHTON of Stamford, Vt.
Secretary — H. CLAY BLISS of North Adams.

HOUSATONIC.

President—HENRY W. SHELDON of New Marlborough.
Secretary—HENRY T. ROBBINS of Great Barrington.

BRISTOL.

President—THEODORE DEAN of Taunton.
Secretary—D. L. MITCHELL of Taunton.

PLYMOUTH.

President—JOHN LANE of East Bridgewater.
Secretary—LAFAYETTE KEITH of Bridgewater.

HINGHAM.

President—EDMUND HERSEY of Hingham.
Secretary—WILLIAM H. THOMAS of Hingham.

MARSHFIELD.

President—GEORGE M. BAKER of Marshfield.
Secretary—FRANCIS COLLAMORE of Pembroke.

BARNSTABLE.

President—AZARIAH ELDRIDGE of Barnstable.
Secretary—F. B. GOSS of Barnstable.

NANTUCKET.

President—RICHARD E. BURGESS of Nantucket.
Secretary—WENDELL MACY of Nantucket.

MARTHA'S VINEYARD.

President—HORATIO G. NORTON of Tisbury.
Secretary—B. T. HILLMAN of Chilmark.

AGRICULTURAL EXHIBITIONS, 1880.

ESSEX, at *Lynn*, Sept. 28 and 29.
MIDDLESEX, at *Concord*, Sept. 29 and 30, and Oct. 1.
MIDDLESEX NORTH, at *Lowell*, Sept. 28 and 29.
MIDDLESEX SOUTH, at *Framingham*, Sept. 21 and 22.
WORCESTER, at *Worcester*, Sept. 7, 8, 9, and 10.
WORCESTER WEST, at *Barre*, Sept. 30 and Oct. 1.
WORCESTER NORTH, at *Fitchburg*, Sept. 28 and 29.
WORCESTER NORTH-WEST, at *Athol*, Oct. 5 and 6.
WORCESTER SOUTH, at *Sturbridge*, Sept. 16 and 17.
WORCESTER SOUTH-EAST, at *Milford*, Sept. 28, 29, and 30.
HAMPSHIRE, FRANKLIN, and HAMPDEN, at *Northampton*, Oct. 6, 7, and 8.
HAMPSHIRE, at *Amherst*, Sept. 23 and 24.
HIGHLAND, at *Middlefield*, Sept. 16 and 17.
HAMPDEN, at *Springfield*, Sept. 28, 29, and 30.
HAMPDEN EAST, at *Palmer*, Sept. 21 and 22.
UNION, at *Blandford*, Sept. 22, 23, and 24.
FRANKLIN, at *Greenfield*, Sept. 30 and Oct. 1.
DEERFIELD VALLEY, at *Charlemont*, Sept. 23 and 24.
BERKSHIRE, at *Pittsfield*, Oct. 5, 6, and 7.
HOUSATONIC, at *Great Barrington*, Sept. 29 and 30, and Oct. 1.
HOOSAC VALLEY, at *North Adams*, Sept. 21 and 22.
BRISTOL, at *Taunton*, Sept. 28, 29, and 30.
PLYMOUTH, at *Bridgewater*, Sept. 22, 23, and 24.
HINGHAM, at *Hingham*, Sept. 14 and 15.
MARSHFIELD, at *Marshfield*, Sept. 15, 16, and 17.
BARNSTABLE, at *Barnstable*, Sept. 28 and 29.
NANTUCKET, at *Nantucket*, Sept. 8 and 9.
MARTHA'S VINEYARD, at *West Tisbury*, Oct. 5 and 6.

AGRICULTURE OF MASSACHUSETTS.

FARM CROPS.

THE PEAR.

[From the Report of the Committee of the Essex Society.]

It is only a few years since the pear began to be regarded with any thing like favor by people in general. In our own Essex County, where the pear is so well known and extensively cultivated, there are not pears enough raised to give four quarts to every family within its territory. This ought to be encouraging to persons desiring to cultivate the fruit for pecuniary profit, the more so as the demand for it is so great. Those who consumed but one quart last year will want at least two quarts this year. The taste will increase for it from year to year, till it will find its way to the table of the poor as well as to that of the rich.

The Committee are of the opinion that all fruit-growers should raise their pear-trees from the seed. They have come to this conclusion for various reasons. First, as animals are improved by breeding from pure and healthy stock, why not apply the same rule to the raising of trees from pure and healthy seed? Second, every one who has had any experience with trees sold by nursery agents can tell the loss sustained from that source. We have known some of these trees to struggle for existence two or three years, and then die; others to live through the first season only; and some that did not put out at all. This, to say the least, must be aggravating to the purchaser, who wastes his money and labor in setting out worthless plants raised from worthless

seed grown on diseased trees. In Western New York, where this wholesale business is generally done, there is seemingly but very little regard paid to the future health, thrift, and fruitfulness of the plants: on the contrary, they raise from any thing and every thing that bears pears, and force the trees along, somewhat after the manner that some manufacturers shove shoddy shoes into the market, and that is the end of it with them. We have every reason to believe that trees thus propagated from varieties affected with disease will sooner or later fall a prey to its destruction.

RAISING FROM SEED.

The chief object of raising trees from the seed is to obtain stocks for budding or grafting, as it is well known in pear-culture that no variety will reproduce itself from the seed: hence the resort to artificial methods for propagation. The first step to be taken towards this is to select for seed the best specimens when fully ripe, grown on sound, vigorous, and healthy trees; when this is done, place the fruit in a box, and leave it until decay reduces it to a pulpy state; then wash out the pulp, and dry the seed by spreading it thin on a board, and turning it over occasionally, as any seed.

If the soil or ground is naturally dry, deep, and rich, the best time to plant the seed is in the fall, in drills three feet apart. This distance will admit of going between them to keep the soil pliable and mellow when the plants are up. When the drill is made, open it with a hoe about five inches wide and three deep, then drop the seed, and draw over it with the hoe the fine pulverized earth as evenly as it can possibly be done. A top-dressing of decomposed stable-manure or partly decayed leaves, to the depth of an inch or so, should be applied. This will prevent the surface in early spring from baking or cracking, which will help the plants to come up readily, strong and vigorous. The covering on the seed should not be too deep, — not over three inches including the top-dressing.

Care must be taken that they be not in any way stunted, either by any obstacle in the way coming up through the soil, or by weeds and neglect afterwards. Seedlings stunted in the early stages of their growth never make sound, thrifty, healthy trees, and therefore should never be planted. If they come up too close together, they should be thinned out, when

four or five inches high, to regular distances, — about ten inches apart. When left too thick, they grow up slender and feeble, and consequently unfit for further use. As one strong seedling is worth twenty poor ones, we must see the importance of thinning out all the weakest plants. Pear-seedlings of one season's growth must be taken up late in the fall, before the ground freezes, and packed close together. Having no side-roots to hold them in the soil, they cannot stand the severity of the hard blasts of winter. The best place to keep them is a dark, cool cellar, where frost will not touch them. In transplanting them in early spring, when the ground is fit, cut back a portion of the tap-roots, and shorten the stem correspondingly. Set them out two feet apart in drills, which will give them ample room to throw out lateral roots, and grow strong and stocky. We know of a party in Bradford who lost several hundreds of pear-seedlings by leaving them in the ground the first winter. If a strong, vigorous growth is obtained after transplanting, they will be fit to bud the same season, — about the middle of August.

BUDDING.

Now, then, having procured good healthy stocks to bud on, it will also be necessary to procure good, sound, healthy buds. This can be easily done by selecting, from the varieties that are to be propagated, strong vigorous shoots, free from any disease. Pinch off their tip ends, and let them grow until wanted. This will hasten the development of the buds, and they will be in good condition to use in about two weeks. None but the most prominent buds should be used under any circumstance, as it is this little bud, that is inserted under the bark of the stock, that becomes in future the standard tree. Budding is simple enough when rightly understood.

The first thing to be done in performing the operation is to remove from the stock any shoots that would be apt to interfere with the insertion of the bud; then, with the budding-knife, make two incisions in the stock, — one horizontal, and the other perpendicular,— in the form of the letter T, about two or three inches from the ground; strip off the leaves from the bud-shoot, but leave a portion of the leaf-stock attached to the bud to handle it with. In cutting the bud off, hold the shoot in one hand and the budding-knife in the

other; enter the knife half an inch above the bud, and draw it down parallel with the shoot, and bring it out three-quarters of an inch below the bud. Care must be taken to make a clean cut, and not to take off any wood with the bark. But, if a little should be taken off, see that it adheres firmly to the bark, as ragged bark and little slivers of wood hanging to the bud will never do.

Use the end of the handle of the budding-knife to raise the bark gently on the edges of the perpendicular cut; then the bud may be inserted under the bark, and care must be taken that the piece of bark attached to it be cut square at the top, so as to fit snugly to the bark on the horizontal cut. Tie with palm-leaf or such as is used in cane-seat chairs. Success in this operation will depend entirely on clean cutting, good fitting, and good tying. Budding should be done on the north or east side of the stock, because thus the stock will partly shade the bud. Too much exposure to the sun's heat during August and September is apt to interrupt the process of healing by curling the tender bark on the wound, and perhaps cause budding over again. In about four weeks, if the bud has caught, the strings may be removed, to save the bark from denting.

The following spring after budding the seedling, that is, if the bud is all right, rub off all the shoots appearing on the stock, so as not to impede the growth of the bud. During the latter part of July or the first of August all above the bud of the stock may be removed by making a sloping cut clean and smooth, and close to the bud, but not so close as to cause any injury to it. Now we will go to work again on the seedling the next spring, that is, the second spring after budding, at which stage the tree is one year old from the bud. All further treatment comes under the head of pruning, as here comes the time to commence to give it shape and form.

The first question comes, then, What distance from the ground should it branch out, and grow stocky? There is no definite rule, that we are aware of, on this point, as some people prefer tall trunks, while others prefer low ones. However, we are of opinion that no standard pear-tree should have a branchless trunk above three feet from the ground. This, in a manner, gives the tree the advantage of shading itself from a hot, glaring sun, and is a safeguard, in a meas-

ure, from high winds. We are also of opinion, from a little experience, that the pyramid or umbrella shape is the handsomest and best form that can be adopted, not on account of its beauty alone, but it admits readily sun and air through the branches. During the second season's growth of the young tree, the small shoots on the stem or trunk should not be taken off, as they retain the sap in the lower part of the stem, which will give it a stout body. But they must be kept within bounds, and not allowed to grow too long, by pinching often through the season, as allowing them to grow too fast would check the growth of the leader. Late in the fall, or early the following spring, all the side-shoots should be removed, and a branchless trunk formed to three feet from the ground, as already spoken of.

To form the pyramid or umbrella shape, all straggling and tender side-branches must be watched closely as they grow long and weak, and draw the sap from the leader: pinching off the ends of all such will regulate an equal circulation, which will cause every branch to grow stocky and strong. Let every shoot, commencing with the lowest, be about ten inches shorter than the one next above it, and so on to the top, and allow no surplus shoots to grow. Thus is obtained the fine symmetry of the perfect tree and a uniform growth on every limb.

What can be more repulsive to the eye than to see gardens encumbered with tall, straggling skeletons, unshapely and unfruitful, packed closely together, that afford no pleasure to the passer-by, nor remuneration to the owner for his outlays? Most trees have a natural tendency to grow tall without acquiring proportionally a stocky body; and very often, for that reason, the tree bends under its own weight, and hence the necessity to resort to propping it up. To avoid this altogether, prune, and let the sun and air circulate freely through the tree, that every branch may have ample room to fulfil its functions properly. It is well known to all fruit-growers that the most perfect specimens of every kind of fruit grow in the sun, not only perfect, but their skins are smooth and glossy, and brilliant in blush. This will give us an idea about pruning, and what to prune, and how to prune. A little experience and study will enable any one to acquire this knowledge, which should be strictly practised on every fruiting tree.

GRAFTING.

Grafting is a science long known in fruit-culture, and various modes of grafting are practised in different countries. The French, it is said, have no less than fifty, and excel all others in the art. The most prominent modes in vogue with them, however, are whip, root, splice, skin, and cleft grafting: their other modes are principally experimental. The object of grafting is similar to that of budding, — to multiply varieties that cannot reproduce themselves from the seed; though it is often performed with other objects in view, such as obtaining a new variety quicker than by any other mode. A scion inserted in a bearing tree will hardly ever fail to produce the third year; but this cannot be said with the same operation on a seedling: it will show no sign of fruiting in that time. Therefore we must see the importance of having older trees, and of the strong-growing kinds, for stocks to accomplish the object successfully. The slow-growing kinds are never apt to bring good results.

Crossing two healthy varieties of the pear family cannot but work very important influences on both scion and stock in producing fine fruit, as we have seen the Bartlett grafted on the Doyenne Boussock, the Dutchess on the Buffum, the Beurre d'Anjou on the Onondaga, Clapp's Favorite on the Flemish Beauty, produce very fine and extra large specimens. The society has paid a premium two years in succession on specimens of the Beurre Clairgeau pear grown from grafts on a Flemish Beauty stock. The Flemish Beauty, Beurre Diel, Doyenne Boussock, Doyenne White, Buffum, and Vicar of Winkfield, make most excellent stocks for most all other varieties.

Grafting is performed by inserting a scion of one variety on the branch of another, called the stock; and trees of all ages can be grafted successfully, if they be sound and healthy, and the scions also. Scions are shoots of the previous year's growth, and should be cut in February, and tied up. The butt ends should be cut square, then placed standing in some part of the cellar-floor where it is a little moist. Scions thus treated are kept dormant until wanted, with no shrivelling of the bark, and will be in an excellent condition to use. They should be taken from the upper

branches of thrifty and hardy trees well matured. Scions bearing fruit-buds should not be used, and a medium sized scion is better than one half an inch in diameter, pithy, and unripe. The implements used in grafting are very simple, — the grafting-knife with chisel attached, saw, and a sharp knife to prepare the grafts with.

There are various opinions expressed in regard to what is the best composition to be used in grafting. This subject was once extensively discussed before the Bradford Farmer's Club. Some preferred a composition made from beeswax, tallow, and rosin, equal parts. Others substituted linseed-oil for tallow, with less beeswax, and more rosin than of either. But the majority, from long experience, concluded that there was nothing equal to a simple composition made from fresh cow-manure and brick-clay: one-third manure to two-thirds clay is about right to use. It will adhere firmly to the wound until it is all healed, and retains moisture, which is requisite during the process of healing. When it falls off, it leaves the bark on the wound healthy, fresh, and smooth: in fact, it is nature's own remedy, and we have never known it to fail. On the other hand, a composition made from oily substances must be injurious to the tree, as it is foreign to its nature, and hence it cannot but interrupt, in a great measure, free circulation, and impede progress in healing. Aside from grafting, we believe that oil or grease should not be applied in form to a tree; and in grafting, if the other agents used in the compound did not counteract the action of the oil on the wound, the wound would never heal.

Of the several modes of grafting spoken of in our introductory remarks on grafting, we shall only recommend two for practical use; viz., skin and cleft grafting. Having every thing in readiness, — composition, scions, implements, strips of cloth, thread to tie with, &c., — skin-grafting is performed after this fashion: saw off the stock horizontally with a fine-tooth saw, clean and smooth, and cut the scion on one side, about an inch and three-fourths long; make a shoulder at the top of the cut on the scion, and a slit in the bark of the stock to admit it (care should be taken that the slit in the bark of the stock does not exceed in length the cut on the scion); raise the bark from the stock, and

insert the scion between the bark and wood; have the shoulder rest on the stock; then apply the composition all over the wound; wrap a strip of cloth (cotton) about three inches wide around it firmly two or three times, and tie with small thread. We have heard objections to this mode of grafting, on account of the graft being blown off before growing firmly to the stock. Nevertheless we have tried it with success, and found it makes a strong, perfect union, when the scion has grown as large as the stock.

Cleft-grafting is performed by sawing the stock, as in skin-grafting, clean and smooth; then the stock is split by holding the grafting-knife in the centre, and striking lightly with a hammer, use the chisel on the knife to keep the split open until the scions are inserted, one on each side; cut the scion in the shape of a wedge to fit snugly the split in the stock, and have a bud on it close to the stock on the outside; when this is done, insert the scions firmly in the stock, and see that the inner barks of both scion and stock come in perfect contact; then apply the composition, as in the case of skin-grafting, and fill every crevice to exclude air and rain-water; wrap a strip of cloth two or three times round it, and tie with thread, as in skin-grafting. Success will depend on good fitting and clean cutting.

In large stocks an inch and a half in diameter, or more, two scions should be inserted; but, if both grow, one should be removed when they get close together, as the wound on the stock will then be healed, and only one is needed. Prune back the growth on the scion the following spring so that it may grow stocky, and throw out shoots close to the stock, to form a new head for the tree. Grafted trees should be watched closely during the growing season, as they throw out immense quantities of suckers, which, if left to grow, will almost starve the young grafts. These should be checked as fast as they appear, though it is necessary to leave part of the branches on the stock to balance growth. They may be removed altogether the second or third season, or according to the size and growth of the tree. A little experience will teach how to regulate this.

SOILS AND PLANTING.

The most desirable soil for pear-trees is deep, loamy soil, not merely for producing thrift and fruitfulness; but the fruit grown on such soil is superior in flavor and nutrition. There are other soils, such as sandy and clayey soils, that, by judicious treatment, might be made available for pear-culture. Mixing ashes, clay, or muck, with sandy soil, will be a great improvement, as these agents retain moisture and the soluble parts of manure, that will enable plants to stand the drought better.

Clayey soil of itself makes very poor soil for all kinds of fruit-trees, as in dry seasons it bakes hard, and cracks, rendering it too impervious to that best of all plant-food, the cool dews of night, in the spring and fall, and, after heavy rains, sticky mud, not fit for trees to stand in.

The most proper way to improve such soil is first to tile-drain it, then to incorporate with it sand, muck, coal or wood ashes liberally. All kinds of soil for fruit-trees should be dry, either naturally, or made so by a system of drainage.

In preparing soil for planting trees, plough eighteen inches deep or thereabouts, bringing the subsoil on top. This can be accomplished by going twice in the same furrow, first with a common plough, then with a subsoil. Small gardens, where the plough cannot be used, can be dug with a spade any required depth by trenching, which should be done in this manner: commence on one side, and open a trench two feet wide or so, and in depth as recommended for ploughing; carry off to the opposite side the dirt taken out of it (to be used in filling the last trench), then open the next, and throw the surface-soil into the bottom of the first, and subsoil on top, and so on until the whole garden is trenched. In all cases for fruit-trees, grape-vines, &c., this depth is essential, as the roots will certainly go that distance downwards in search of food. If not ready to plant when your trees arrive, heel them in at once, by opening a trench deep and wide enough to admit all the roots, being careful to cover the roots well to exclude air. When ready to plant, take off all bruised roots and mutilated branches, making a clean slanting cut every time, and cut back the last year's growth to two or three buds.

Make the hole somewhat larger than is necessary to admit of all the roots in their natural position, and throw out the surface in one pile and the subsoil in another. Sink the hole about two feet and a half deep; round it up with surface-soil, and have three inches of the trunk, above where the roots branch out, covered, on a level with the surface. A great many trees are spoiled by both deep and shallow planting. To set a tree to the proper depth, use a narrow strip of board about five feet long; lay it across the hole on the surface, then set the tree in the hole; measure three inches from where the upper roots branch out on the tree to the under side of the strip; work pulverized surface-soil between and under the roots with the hand; stretch out every little fibre carefully, and, when the roots are well covered, tramp down hard, so that the tree will stand as firm as a post. Spread the subsoil on top light and loose.

Trees should be set leaning a little towards the north-west, as most of our heavy gales blow from that direction, and young trees with heavy tops cannot resist their force: consequently we see a great many in our travels leaning towards the east or south-east, when from seven to ten years old. Use no manure in contact with the roots, and mulch, especially during the first season, with coarse straw, salt hay, or corn-stalks: this will keep the soil cool and moist round them, and prevent injury from droughts in dry seasons.

The proper distance apart for pear-trees in orchards is about twenty feet each way; but this distance cannot be well adopted in small gardens. We very often see one tree growing under the shade of another; but the result is tall, straggling skeletons, without shape or form, and, as a rule, unproductive. In cases of this kind it is better that one tree should occupy the whole space taken up by two, as the yield thereby would be improved in quantity and quality, to say nothing of the general welfare of the tree. In all cases give them plenty of room, good deep, dry soil, clean culture, severe pruning, and success will be the reward.

We very often hear some persons recommend, when planting trees, to fill up the bottom of the holes with old shoes, glass bottles, pieces of scrap-iron, tin cans, old crockery, and any kind of rubbish; but for what purpose we have yet to learn. It may be safely said that none of the articles

named contain any plant-food, and, furthermore, we believe that such rubbish would greatly interfere with the roots taking a firm hold in the soil. This rubbish must work up towards the surface by the action of the frost, the same as stones, which would be a great nuisance in a garden until removed.

THE PEAR-BLIGHT.

The so-called fire-blight is the most dangerous disease that the pear-tree is subject to; but whether it is caused by the sudden changes of the atmosphere, imperfect drainage, or heavy manuring remains, in a measure, to be proved.

The disease makes its appearance at different periods,—sometimes in early spring, before the trees put out, and through June and July, long after the leaves are out, attacking the branches first. We believe that heavy manuring has every thing to do with this disease, as stimulating the soil too highly with rich manure forces immature growth, which cannot stand the changes of our climate without injury. Mr. Richard Webster of Haverhill says that he has been almost entirely exempt from this disease in an orchard of over four hundred pear-trees. He laid it down to grass seven years ago, and it has borne heavy crops of fine hardy fruit nearly every year since. He also says that his orchard has had no top-dressing of any kind during that time, which is a strong argument against heavy manuring. We have said, and believe it, that over-manuring and imperfect drainage are some of the causes that produce the blight: still there are other agents that work death to all kinds of fruit-trees, and one is growing corn, oats, barley, or rye between and around them, especially corn, which draws from the soil its fertilizing substance or materials, robbing the trees of that which by nature belongs to them. This is proved by the present appearance of a once beautiful pear-orchard, of some one hundred trees or more, owned and cultivated by Mr. Albert Kimball of Bradford. This orchard was set out in 1864, and has been planted, to our knowledge, with corn almost every year for the last ten years, growing every year a heavy crop; but what has been the result? The trees made a fine growth during the first eight years; and after that Mr. Kimball began to lose some of his trees from the blight, and kept

losing more and more every year, till this season, when the destroyer made a wholesale sweep, leaving in its march but very few of what might be called sound trees in the whole orchard. We must ascribe this to being planted with corn so long, rather than to heavy manuring; though it is well known to fruit-growers that trees grown in rich soils are about the only ones affected with the disease. No plants that make a hard, woody fibre, like corn, rye, &c., should be grown around fruit-trees; as such plants, being fast growers, take to themselves a large part of the plant-food in the soil at the expense of the trees. We hope to obtain the experience of others on this point in next year's report, as it is a question that interests every fruit-grower throughout the country.

Before bringing this report to a close, we would ask permission to stray away from our subject for a moment, and call attention to those unsightly stumps, called apple-trees, that line our thoroughfares, and take up much valuable room in fields and orchards. We have reference to those seen as if ready to tumble down, having hollow trunks surrounded with root-suckers, white, branchless limbs, and gray with age all over. Such trees, in our opinion, ought to have long since found their way to the wood-pile to make room for others more beautiful and profitable. Clear away along the stone walls, also, and burn up all the rubbish. Then may it be said of us, that we have well filled our sphere in cultivating the soil, and left it better than we found it.

JOHN O'BRIEN, *Chairman.*

THE APPLE.

[From an Essay presented to the Hampshire Society.]

Fruit-trees must be taken care of as well as other crops, if one would realize any thing from them. One would not expect a crop of corn if he merely planted the seed in the spring, without giving it any manure or after-cultivation: such an one would be called a shiftless farmer. There are many who are called good farmers who are shiftless fruit-growers; and the reason is this, they have been taught to look upon fruit as an expense, rather than as a source of income from the farm. If one will only stop and figure, he will find that there is not a crop grown on the farm which pays as well, compared with the expense laid out on it, as fruit. Take, for example, the apple, as that is the standard fruit of this latitude, and the one most generally grown.

It is well to speak of this fruit in particular, as the past season has been one of such productiveness, that many are on the point of cutting down their apple-orchards to make room for some other crop, saying that they had better raise corn than to grow apples at the present prices. This is not so. A farmer can make more clear money by growing apples at seventy-five cents a barrel than he can on any other farm-crop. To prove this, let us see what it will cost to take care of an acre in orchard, and also one in corn. Admitting that corn can be grown for thirty-five cents per bushel, and forty bushels are raised on an acre, the cost of growing would be fourteen dollars: the price of corn we will take at sixty cents per bushel, which will amount to twenty-four dollars: this gives a profit of ten dollars from one acre. Now let us see what one will get if he plants an apple-orchard. We will reckon the trees, when planted, at twenty cents each. If they are set twenty-five feet apart each way, it will take

sixty-nine trees to the acre, costing thirteen dollars and eighty cents all planted. As it will be about six years before the trees begin to bear, the ground should be cultivated, and kept well stirred. When the trees commence bearing, seed the land to grass, as apple-orchards in bearing do better in grass.

We will take the average yield per tree for the first three years at one peck, or seven barrels a year, which would be worth, at fifty cents per barrel on the tree, three dollars and fifty cents: the three years would give ten dollars and fifty cents. The next three years one gets three pecks from a tree, or twenty-one barrels each year, worth ten dollars and fifty cents, or thirty-one dollars and fifty cents for the three years. The next three years one gets one bushel and a half from a tree, or forty-one barrels, worth, at fifty cents a barrel, twenty dollars and fifty cents per year, or sixty-one dollars and fifty cents for the three years. Now we have, over and above the use of the land and all labor, ten dollars and fifty cents, thirty-one dollars and fifty cents, and sixty-one dollars and fifty cents, or one hundred and three dollars and fifty cents: deducting twelve dollars and forty-two cents, interest at six per cent on the cost of trees for the fifteen years they have been planted, we have, over and above all expenses, ninety-one dollars and eight cents, as the hay cut will pay for the use of the land.

Now, if corn had been planted from the time the trees had begun bearing, we would have ten dollars profit each year, or ninety dollars for the nine years the trees have borne: this gives one dollar and eight cents in favor of the apples.

The orchard, now having been planted fifteen years, is just beginning its work, and for the next twenty-five years will average a barrel and a half per tree, worth, at fifty cents per barrel on the tree, about fifty-two dollars per acre above all work and use of the land. Now, let us take the actual yield of ten trees not above medium size, — four Baldwins and six Greenings. These trees produced sixty-four barrels of picked apples, which at fifty cents per barrel on the tree, or, to be exact, forty-seven cents and a half, the price for which they were sold, gives three dollars and four cents per tree, or two hundred and nine dollars and seventy-six cents to the acre. Reckoning a crop only every other year, we

have one hundred and four dollars and eighty-eight cents every year. These ten trees bore, two years ago, over seventy barrels of picked apples. We have called apples worth fifty cents a barrel; but this is much below their average value. The average price received for apples from an orchard of twelve hundred and fifty trees, — of which six hundred were Baldwin, four hundred Roxbury Russets, the remaining two hundred and fifty of different varieties, — by a fruit-grower near Rochester, N.Y., from 1871 to 1877 inclusive, was two dollars eighty-six and two-thirds cents per barrel.

If by this it is shown that one can afford to grow apples, the first thing to be considered is the soil and location. An orchard of any kind does better on high ground than on low, for various reasons. The fruit-buds are less liable to be injured in winter by thawing and freezing: they will be kept from starting as soon in spring, so that there will be less danger of injury from late frosts. High ground is usually well underdrained; and this is important, for fruit-trees of any kind will not do well where there is stagnant water in the soil. A wet soil is to be avoided, also one that is very sandy: for a tree cannot put on a healthy growth on a wet soil; and in a very sandy one, if it grows at all, it will be short-lived. Land that will grow good corn will usually grow good apples.

Now comes the question of variety; and here is where many make a great mistake. If one wants to raise apples for his own use, he should plant so that he will have them from the earliest to the latest; but, if one intends to grow fruit for the market, he should select only those which bear large crops, and will sell well. The best varieties to plant in this section, where we have a poor market for early apples (if one intends to raise fruit to sell), are Baldwins, Roxbury Russets, and Rhode-Island Greenings: these three varieties will produce more fruit than any other three varieties grown about here. The Baldwin will yield more fruit per acre than any other variety we grow. It has one advantage in the market over many other varieties, on account of its color; for a red apple, as a general rule, sells better than one of any other color. If the soil is suited to the Roxbury Russet, so that it will not grow knurly (as the russet, to produce good

fruit, requires a stronger and richer soil than many other varieties), it is one of the very best apples to grow. It will keep until other apples are gone; it bears more or less every other year; and, if kept till other kinds are gone, it will bring a fair price every year.

The best varieties of early apples are Williams's Favorite, Red Astrachan, and Early Harvest, for sour; Golden Sweet and Sweet Bough, for sweet. The Williams's Favorite is not as well known about here as it should be: it is considered the best early apple grown in the eastern part of the State, and I would recommend it to all who have not already tried it as worthy their attention.

It costs no more to grow a good variety than it does a poor one. There are a great many good apples; but it pays to grow very few of them, for a variety may be excellent in flavor, but a shy bearer: this must give place to some more productive kinds; for, no matter how fine a fruit may be, if it is not a bearer, it is not a profitable kind to grow. Don't run any risks by planting out new varieties that have not been tested, no matter how much the nurseryman or agent may recommend them; for the chances are one hundred to one that they will not prove to be as profitable as some of our older kinds. My advice to all who cannot afford to raise fruit for pleasure is to plant nothing but what they know to be good, and to let others experiment with new varieties.

The ground on which an orchard is to be planted should, if possible, be ploughed; then it will make very little difference whether the holes dug to receive the trees are large or small, provided they are large enough to take in all of the roots without crowding them. If the ground is not ploughed, the holes for the trees should be much larger, not less than three feet in diameter; which space should be kept well stirred, and free from weeds. As it pays to cultivate fruit-trees, a tree that has been well taken care of will grow as much in six years as one that has been neglected will in eight or ten. If the ground can be cultivated, the cheapest way to take care of an orchard until it begins to bear is to plant it each year with corn, potatoes, or some other hoed crop, but never sow grain of any kind in an orchard.

If the trees have been properly pruned up to the time

they commence bearing, they will need very little pruning afterwards, except the cutting-away of dead and broken branches. In shaping the head of an apple-tree, see that it is well balanced, and not too open; for a tree with an open head is continually throwing out suckers or water-sprouts, and, where one is cut away, several are almost sure to grow. If the head has been formed as it should have been, the branches will be so distributed that they take up all of the nourishment, and there will be very little trouble from water-sprouts. The limbs should not be left too near the ground, as the weight of the fruit will cause the branches to sink lower each year, and in a short time one will be bothered to work beneath the tree.

It often happens that fruit-trees blossom full in the spring; but, when they are in full bloom, there comes a heavy shower, a thunder-shower for instance, and we have little or no fruit that season. Many attribute it to the influence thunder and lightning have on the blossoms; saying, that, if there is thunder and lightning when the trees are in full bloom, the crop will be ruined for that year. This is a mistaken idea. If one will examine, and see how an apple-blossom is formed, he will find that it is composed of stamens and pistil, or the male and female organs of the flower, and calyx and corolla, or what might be called the leaves of the flower. The stamens, or male organs of the flower, produce a yellow dust, or powder, called pollen, which comes in contact with the end of the pistil, and fertilizes it: if there should be a dashing rain, this yellow dust, or pollen, will be washed away, and the pistil will go unfertilized, the flower drops off, and the crop becomes a failure. The reason why people attribute the failure to thunder and lightning is probably because a thunder-shower is more of a dashing rain than our other showers, and more apt to wash away the pollen.

The great obstacle in the way of many farmers planting apple-trees is, that they bear only every other year, and, the years they do bear, apples are so plenty that one hardly knows what to do with them; while the next year they do not bear at all. There must be some reason why trees bear one year, and not the next; and, if we can find out the cause, is there not a chance of changing the bearing years of our apple-trees, so that they will bear moderate crops every year,

or large crops the odd years? The production of fruit tends to weaken the tree, and, the larger crops a tree bears, the more will it be weakened or exhausted; so that all the nourishment or plant-food the tree can prepare is used in ripening its fruit, and there is none left to develop fruit-buds for the coming season: the result is, our trees bear only every other year.

In the rich prairies of the West, apple-trees bear more or less every year. I think this was the case when it was first settled about here; but continual cropping has so exhausted the soil and the trees, that they cannot obtain and prepare sufficient plant-food to ripen a crop of fruit, and develop fruit-buds, the same season. If the bearing only every other year is due to over-bearing these years, exhaustion of the soil or trees (as it undoubtedly is to some or all of these causes), we have it in our power to change the bearing years of our fruit-trees, and make them bear the years we want them to bear. This is something worth giving particular attention to: if trees can be made to bear the odd years, it would make considerable difference in the returns from an orchard. I have in mind a man who has quite a large orchard that bears the odd years. He received for his fruit, for the seasons of 1877 and 1875, from three dollars and seventy-five cents to four dollars per barrel; for 1873, 1871, and 1869, from five to six dollars.

There are two ways by which the bearing years of an apple-tree can be changed. One is by taking scions from trees bearing the odd years, and only the odd years, and grafting with them. I know two men who have practised this method. One of them says they come true nearly every time, nearly eighty per cent. The other says that sometimes they would come true nearly every time, then again very few would come true, but says, that, by manuring the trees well the even years, he believes they could be entirely changed. This would be worth trying, as many orchards scattered up and down this valley contain about as many varieties as they do trees; and more than half of them are good for nothing but cider. If such trees were grafted over with Roxbury Russets or odd-year Baldwins, they would become more profitable, if they bore the even years, than to let them remain as they now are.

In top-grafting a tree of any considerable size, all of the limbs should not be cut away, but enough left to shade the trunk and branches destined to remain; if not, the hot sun during summers will so scorch the south side of the trunk, and upper sides of the branches, that the bark will be killed, and large bare places will be seen without any bark. After the grafts have begun to grow, the remaining limbs should be cut away from time to time, sufficient to give the grafts room to grow without being crowded. Grafting consists of taking a branch or scion from one tree, and putting it into another, or the same, so that it will grow. The principal things to be taken into account are these: the grafts should be of the last season's growth; in cutting the scion, care should be taken to make the cut true, and with a single stroke of the knife, as it will be much easier to fit the scion to the stock than if cut irregularly. In fitting the scion, see that the inner bark of the scion comes in contact with the inner bark of the stock; as it is here that all growth takes place, and also where the union is formed. A good grafting-wax can be made from either of the following proportions: beeswax three parts, resin three parts, and tallow two parts, by weight; or, linseed-oil one pint, resin six pounds, and beeswax one pound. These should be melted together, and well stirred. As soon as it is cooled, it is ready for use. In putting on the wax, be sure that the entire wound made is covered by it, so that no air can get in. The only use of wax in grafting is to exclude the air. Apple-trees can be grafted any time in spring before the leaves begin to grow, or even after if the scions have been kept in a dormant condition.

The other way of changing the bearing year is by picking off all of the blossoms, or fruit before it gets to be of any considerable size, that all the nourishment the tree is able to take up and prepare shall be used in making new growth, and developing fruit-buds. It is no more the nature of the apple-tree to bear the even year than it is the odd year: its nature is to bear every year; but overbearing, exhaustion of the soil and tree, or some outside cause, has so weakened or affected the tree, that it bears enormous crops one year, and not any thing the next. Every fruit a tree bears robs the tree of that much nourishment: this nourishment is obtained

from the soil through the roots, and by absorption from the atmosphere by the leaves, which also digest and prepare the crude food thus taken up. The tree is a machine to transform the elements of the soil and air into fruit: this machine can do a certain amount of work, and not over-exert itself; but, if it goes beyond this limit, the tree is over-taxed, and it either dies, or is obliged to rest until it has made up for this extra work. It is a fact worth remembering, that every fruit a tree bears over a medium crop must be paid for from the next season's fruit.

Most of our apple-trees bear enormous crops the years they do bear, and by so doing exhaust the tree, so that it is obliged to rest a year before producing another crop. The season the tree does not bear, all of the plant-food prepared goes to form new growth, and develop fruit-buds. The tree is stored full of nourishment, and bears another large crop the next year; and it will continue in this manner if no outside influence is brought to bear upon it. If we can keep trees from bearing the years they want to bear, which we can by picking off the blossoms, and, by manuring well these years, cause the trees to put on a good growth, they will naturally develop fruit-buds, and bear the coming year. I do not say that picking the blossoms off for a single season will absolutely change the bearing years, so that it will not bear at all the other years, as the tree has had two seasons in which to store up food, and there may be sufficient to ripen a large crop, and develop fruit-buds for the next year; but, if one will follow this up for two or three years, I see no reason why the bearing years of any tree cannot be changed.

There are instances where trees have had their blossoms picked off for a single year. This caused them to bear the next year: but, in some cases, they gradually worked back to their regular bearing years, in others, they bore moderate crops every year. If these trees had been made to fix their bearing the odd year by picking off the blossoms for one or two years more, they would, in all probability, have remained permanently changed. Quite an interesting case of the bearing year of a large apple-orchard being changed, and permanently changed, in a single year, happened not far from Worcester. The year referred to was the bearing year. The trees blossomed full; but the canker-worms were abun-

dant that year, and all the fruit-growers in the vicinity, with the exception of the one referred to, kept the worms from injuring their trees by putting printer's ink around them. This man put nothing on his trees, so that the worms had full play. The consequence was, he had no fruit that year, while his neighbors had an abundance. The next year he put ink on his trees, and kept the canker-worm down: the trees produced a large crop of fruit, and have borne the odd year ever since.

Apples, when first gathered, should not be placed in the cellar immediately, but kept in as cool a place as possible, and not freeze. They can be put in barrels, in heaps under the trees, or, if one has the room, in a building that can be well ventilated; spread on the floor from one foot to a foot and a half in thickness: here they should be allowed to remain until they have done sweating, when they should be barrelled, and kept cool until freezing weather approaches. The barrels should now be headed up, taking care not to fill so full that one will be obliged to press down to put the head in, as it will bruise the top layer, and cause them to decay, so that they will be worthless when opened in the winter to be re-packed for the market. Put in a cool, dry cellar: the nearer apples can be kept to freezing, and not freeze, the better they will keep. Apples should never be wiped when barrelling them for winter; as it rubs off the oily coating with which they are covered, that prevents and keeps them from withering. If the fruit is wet, it should be exposed to the sun or wind until dry, before barrelling.

Of the insects which prey upon our apple-trees, — and there are many, some of which do a great amount of damage, destroying hundreds of thousands of dollars' worth of fruit annually, — I will only speak of the most destructive, beginning with the apple-tree borer. This is a nocturnal insect. The female deposits one egg in a place, upon the trunk of the tree, near the ground. When the borer hatches, it feeds for a time on the bark: as it grows older, it burrows deeper into the tree, often to the heart, when it turns, and comes to the surface, then re-enters again to undergo its transformation, and comes out in the spring a perfect insect. The best way to destroy this borer is to watch the trunk of the trees, and, if castings resembling sawdust are seen about the trunk, to

search for the worm with a knife. If the borer is too deep to be reached with a knife, take a piece of flexible wire, and run into the hole, and destroy the borer: this is the surest way to kill him.

The codlin-moth is also a night insect. The female deposits its eggs singly in the blossoms, or in the blossom-end of the fruit: through this opening the worm, as soon as hatched, makes its way to the centre, and eats the seed and pulp. In warm weather the worm attains its growth in about three weeks, when it leaves the apple, and secretes itself under any thing it can find for shelter. A great many can be caught by placing chips about the trunks of the trees, and turning the chips every few days. The female flies at night; and large numbers can be destroyed by lighting lamps in an orchard at night during the month of June. All fruit that drops prematurely should be gathered up immediately, and fed at once, as the worm leaves the fruit as soon as it drops. If hogs are allowed to run in an orchard, they will destroy a great many insects. The fall web-worms are very destructive to the foliage of apple-trees during the summer and early fall. They live in colonies, and envelop the leaves and branches, on which they feed, with a web. The moth is milk-white. The eggs, from two to three hundred in number, are deposited on the under-side of the leaves, near the end of a branch: these eggs soon hatch, and the larvæ feed on the tender portions of the leaves. These worms are most numerous in September. The remedy is hand-picking, and crushing them beneath the foot.

The larva of the tent caterpillar is so destructive to the foliage of apple-trees that it is often called the apple-tree worm. The moth selects a terminal shoot that has completed its growth, and deposits its eggs, from two to three hundred in number, around the limb, in the form of a sheath, and covers them with a kind of varnish that protects them from the wet. Very early in the spring these eggs hatch, and the caterpillar spins its web, and begins its work of destruction. These caterpillars may be destroyed by either picking off the eggs in the fall, or by cutting away the twig on which the nest is seen in spring, and crushing or burning the worms. The handmaid moth is a brown, hairy, thick-bodied moth, about an inch across its wings. It flies at night, and is very

troublesome about lamps during the month of June. The female insect deposits its eggs on the under-side of the leaves. The worms feed in colonies; and, by lying side by side on the leaves, they consume large quantities of leaves during their existence as caterpillars, which lasts about four weeks. They are striped with black and yellow. One peculiarity of this worm is, that, when at rest, the head and tail are carried into the air above the body, which rests on six legs near the centre: when disturbed, it throws its head from side to side. A constant lookout should be kept for this pest during the months of August and September. They should be picked off, and destroyed. The canker-worm is about the color of the bark of an apple-tree. The female has no wings; but, as soon as warm days come in winter or spring, she leaves the ground, and crawls up the trunk of the trees, and lays her eggs, which hatch about the time apple-trees are in bloom. Trees affected with these worms look as if their foliage had been scorched by fire.

The best way to keep these worms from injuring trees is to tack strips of paper, cloth, or leather, around the trunks, and keep this band wet with coal-tar to prevent the female from ascending the tree to lay her eggs. See that the tar does not get dry: if so, this insect will crawl over it, and lay its egg in the tree, and the mischief will be done. To be successful in the growing of fruits, one must understand the nature of the fruit grown, what diseases it is subject to, the insects that prey upon the tree or fruit, and how to battle with each.

THE CRANBERRY.

ESSEX.

[Statement of H. A. Stiles of Middleton.]

In 1874, the year after I received the society's premium for an experiment in the cultivation of the cranberry, half an acre of the land which grew the premium crop this year was burnt over by sparks from the railroad; and consequently but few cranberries have grown there until the present season. This piece of land was ploughed, harrowed, and rolled down smoothly, and, after setting the vines about ten inches apart, no labor worthy of note has since been expended by way of improvement. As the soil is quite sandy (a very important requisite, considering the comparative cheapness of preparing the land *by ploughing*), I regard it as my best experiment in growing the cranberry.

That portion of land (about an acre) west of the railroad, which contains more muck and less sand, I did not plough, but spread upon the grass about three inches of coarse sand; and it has generally produced good crops of cranberries yearly. Last year the prospect for an abundant crop on all my lots was never so good, until the 6th of June, when that remarkable frost destroyed them. Last September I spread from the cart two inches of sand over this piece of land; and, although the *quantity* of berries was not increased this year, they ripened earlier, and were less injured by the frosts of September, and will, the next few years, amply repay the expense. In setting vines upon land unfit to be ploughed, which produces grass naturally, I would spread upon the surface, in August, from one to two tons of cheap hay per acre, covering the same with two or three inches of sand, for the good of the cranberry, and to keep the hay in place. In the month of May following would set the

vines as thickly as could be afforded, striking the hoe through sand and hay into the soil. The hay acts as a fertilizer to the vine, and *very effectually* prevents the growth of grass.

It is evident, I think, that more cranberries are destroyed by the frosts of June and September than all other causes combined, in this locality: hence the importance of a flood-gate to protect the vines and cranberries by water, where it it is possible to be done. From my own experience and observation I have yet to be fully convinced that continuous flowing in the freezing months is necessary to insure a crop of cranberries. This may seem to be an extraordinary statement; but my reason is this: It is *unnatural* to the vine, and, when covered with water early in autumn, it becomes *very tender* (not hardy) by spring. I have known a crop of cranberries, or the buds of the same, under a mill-pond, to be spoiled by the scorching rays of the sun when the water was let off rather suddenly. I think the bud is oftener injured by frosts after the water is drawn away. If it escapes the heat and cold of April and May, it is more likely to be injured by the frosts of June than those vines that withstood the frosts of autumn and winter without much water.

The cultivation of the cranberry, probably, was conducted on a limited scale until within thirty-five or forty years, when it received considerable attention in the vicinity of Cape Cod; and the consequences have been increased productiveness and improvement of the plant. In most of the New-England and some of the Middle and Southern States, the cultivation of the cranberry has received some attention; but to New Jersey more than any other State is due the credit of bestowing much energy, money, care, and patience, in the culture of this delicious fruit, until it has assumed much importance.

The most important requisite to the successful culture of the cranberry is the *right kind of soil.* The conclusions arrived at by the observation and experience of cranberry-growers generally are that a *moist*, *peaty*, or *muck soil*, intermixed with *beach sand*, and free from loam or clay, is the most suitable. The method of preparing the soil for the growth of the cranberry-vine must vary with the kind of soil. If it be sufficiently dry in summer, the cheapest and most direct method to fit it for receiving the vine would be

by ploughing. It may then be harrowed and rolled down, when it is ready for the vine, which may be set in holes made with the hoe, eight or ten inches apart, covering the roots from one to two inches in depth. If the plot is to be flowed with water during the winter, the vine may be planted as soon as the land is made ready; but, if not flooded, the vine should be set in *spring time*.

The second mode of fixing land for the cranberry, which could not well be ploughed, would be to spread evenly as possible either beach or coarse sand to the depth of from three to five inches, as the case might seem to require, to keep down the grass, until the vine spreads, and checks its growing. In planting the vine, proceed as in the ploughed lot.

The third method of preparing a plot of peat or muck for the vine is to spread evenly a quantity of *litter hay* (perhaps two tons to the acre) upon the surface, covering the same with sand from three to five inches in depth. If this is done in July or August, the vines may be planted in April or May following. The hay will very effectually kill the grass, and many other substances not favorable to the growth of the cranberry, and quicken the growth of the vine in its decaying condition.

There are one or two other methods which may be employed in preparing land for the cranberry. If the patch can be flowed with water during the warmer season, of sufficient depth, it will kill out all vegetation, thus preparing the soil very cheaply for the vine.

Again: if there are substances that cannot be eradicated by water, or by spreading sand, the surface-soil may be removed, putting on sand in its place; but the operation is somewhat expensive, and, the surface-soil being more congenial to the growth of the cranberry, it should be, if possible, retained.

As there are many varieties of the cranberry growing in this region, it is important that those vines be selected that are fruitful, producing *large berries*, *early* to ripen, and of good color. The importance of a flood-gate to prevent by water the destruction by the worm and the frosts of June and September upon the cranberry can hardly be overrated in this locality. The advantage of flowing during the freezing months, when the weather is *uncommonly cold and severe*,

is great sometimes, saving the *fruit-bud* of the cranberry; but the effect of water for several months upon the vine produces an unnatural *tenderness* of the plant, which will not withstand the effects of heat and cold when suddenly drained off in spring time; and the *bud* is oftener *destroyed* than protected.

Cranberries that have grown upon a sandy soil, and have received the sun and air, are generally ripened, and fit to be gathered, from the 10th to the 20th of September. They should be picked by the hand, and spread upon floors, in buildings where the air freely circulates, six or eight inches in depth, to remain until endangered by freezing; and then, after winnowing, and separating the dry and unsound fruit, they may be put in barrels, and placed in a dry and cool cellar, it being the best method for keeping the fruit.

INDIAN CORN.

ESSEX.

[Statement of Francis H. Appleton.]

I had two fields of corn; one consisting of one acre and 4,440 feet, where corn was grown in 1878 with fertilizer alone, and which was then fully reported, and published by the society. Last season the field also included a strip on the east side, which was this year used for garden-vegetables: consequently what was then about an acre and a quarter is now reduced in size as above stated.

Last autumn the piece was harrowed across the rows to level them before it was then ploughed; this spring, four bags and a half of Stockbridge Corn Fertilizer were sown broadcast, and worked in with a Randall Harrow; immediately after this (on May 1) the seed and two bags and a half of the same fertilizer were sown at the same time by the Ross Horse Corn-Planter. The seed was of the eight-rowed variety.

Total cost of raising crop, including interest and taxes, seed, labor in planting, tending, and harvesting .	$25 96
Cost of seven bags fertilizer	31 50
	$57 46

I have harvested seventy-seven bushels and a half of first-quality, and ten bushels of second-quality corn on the cob; also one ton and seven hundred and sixty-five pounds of tops, and two tons and 1,522 pounds of butts and husks, making four tons and two hundred and eighty-seven pounds of stover. This yield of corn is at the rate of about half of, and the stover nearly the same as, last year's crop.

If corn-stover well dried is worth six dollars a ton, then my corn on the cob from this field cost me thirty-seven and

two-tenths cents a bushel; or shelled corn about seventy-four and four-tenths cents a bushel.

The other field contained two acres and 2,668 feet. It had been in grass for a number of years; and, when the committee on farms made me a visit in 1872, I had a crop of potatoes on a part of it, a portion of which had been fertilized by a mixture recommended by Dr. J. R. Nichols, while the remainder was grown on stable-manure. As it was in very poor condition, I ploughed it last autumn; this spring, nine bags of Stockbridge Corn Fertilizer were sown broadcast, and worked with the Randall Harrow; immediately after this (on May 17) the seed and four bags of the same fertilizer were sown at the same time by the Ross Horse-Planter. The seed was of the eight-rowed variety.

Total cost of raising crop, including interest and taxes, seed, labor in planting, tending and harvesting .	$48 56
Cost of thirteen bags fertilizer	58 50
	$107 06

I have harvested a hundred and thirty-six bushels of first-quality, and twenty-four bushels of second-quality corn on the cob, also two tons and 1,172 pounds of tops, and five tons and 1,442 pounds of butts and husks, making eight tons and six hundred and fourteen pounds stover.

If corn-stover well dried is worth six dollars a ton, then my corn on the cob from this field cost me forty-five cents and a half a bushel; or shelled corn about ninety-one cents a bushel.

I ought to say that I was greatly troubled by crows eating the freshly sown seed, and digging up the early growth, on about 22,974 feet at the west side of the larger of these fields. On this part came nearly all of the second quality of corn, thereby reducing the total yield considerably.

I state this fact partly to explain the very high cost per bushel of shelled grain, and to show one of the many annoyances to which every one is liable, and which may tend to make land and fertilizer (or manure) appear much less good and effective than they may be.

Various questions arise in connection with all crops; and in this case let me consider what is best to do with our stover. In my locality it is almost a universal custom to cut

the tops of the corn earlier than the rest, cure them separately, and get them housed before the remainder of the crop is touched. Some farmers who have only a small quantity may make it a practice to feed it without drying. The corn and butts are then harvested together, and the ears are husked at once to prevent heating. Some people, however, husk their corn from the stalks in the field before they are cut, throwing the ears into carts, and carrying them directly to the bins.

All this is different from ways that are adopted in other localities in neighboring counties: there the whole stalks are cut at the ground, with the ears on them, and are strongly placed in well-ventilated stooks, where they can be fully exposed to the drying influence of air and wind. This is done when the ears have become well glazed. When well dried, these whole stalks are taken to the barn to be husked and separated.

I find this latter method most recommended by writers on agricultural subjects; and reasons are advanced why it will produce the best quality of stover. These reasons are explained by the following, taken from L. F. Allen's "American Farm-Book:" —

"If there be no danger of early frost, the corn may be suffered to stand until fully ripe; though, if the stalks are designed for fodder, they should be cut when the grain is well glazed, and this should be done in all cases when frost is expected. Scarcely any injury occurs, either to leaf or grain, if the corn be stooked, when both would be seriously damaged from the same exposure if standing. The stalks of corn should never be cut above the ear, but always near the ground, and for this obvious reason: the sap which nourishes the grain is drawn from the earth, and, passing through the stem, enters the leaf, where a change is effected analogous to what takes place in the blood when brought to the surface of the lungs in the animal system; with this peculiar difference, however, that while the blood gives out carbon, and absorbs oxygen, plants under the influence of light and heat give out oxygen, and absorb carbon. This change prepares the sap for condensation, and conversion into grain. But the leaves which thus digest the food for the grain are above it, for it is while passing downward that the change of sap into grain principally takes place. If the stalk be cut above the ear, nourishment is at an end. It may then become firm and dry; but it is not increased in quantity; while, if cut near the root, it not only appropriates the sap already in the plant, but it also absorbs additional matter from the atmosphere, which contributes to its weight and perfection."

Objection is there made to cutting off the tops while they are green as being injurious as stated above, which seems most reasonable; but, after the corn-crop has turned brown, I can see no harm in taking off the tops, and the ears do not seem to be well glazed until the stalks have begun to turn brown. My reasons for topping corn are, that I can dry that part more readily, and because I have a sufficient quantity of tops not to need the butts, which I have no good market for, and because I believe it is best for me to cut the butts into short pieces with a hay-cutter, and use them for bedding, on their way to increase my manure-heap.

WEST PEABODY, September, 1879.

WORCESTER SOUTH-EAST.

[Statement of J. D. Hunt of Milford.]

The corn was raised on a hundred and fifty-four square rods of land. It bore a hay-crop for the last seven years. No manure has been applied to the land for four years. The soil is a light loam with clay or hard bottom. Three cords of neat-stock manure were spread on the land previous to ploughing the first time. It was ploughed the first time Oct. 25 and 26, 1878. May 20, 1879, I harrowed the land, and May 25 ploughed a second time. The land was ploughed each time about six inches deep. May 26 it was harrowed again. May 27 it was furrowed both ways, three feet four inches wide, and about six inches deep. It was manured in the hill with three cords of neat-stock manure from the barn-cellar, and worked over once, beside carting, making six cords of manure applied to the piece of land. The corn was planted, May 29 and 30, with ten quarts of corn, yellow seed, small cob, large kernel.

The following is the cost of the field of corn:—

Ploughing first time	$5 00
Harrowing first time	3 00
Ploughing second time	4 25
Harrrowing second time	2 00
Furrowing	2 50
Manuring in the hill.	3 50
Planting corn	3 50

Ten quarts seed-corn	$0 75
Six cords of manure at $5.50 per cord	33 00
June 20 and 21, ploughing and hoeing corn	5 25
July 1, 2, and 3, ploughing and hoeing corn	5 00
Oct. 20, two days cutting stalks, binding, and carting	2 50
Oct. 30, two days and a half cutting corn and carting	3 00
Nov. 5, husking corn	5 00
Interest on land	3 00
	$81 25

Cr.

Nov. 8, by 102 bushels of shelled corn at 90 cents per bushel	$91 80
By 1,500 pounds of stalks	7 50
By 2,500 pounds husks	7 00
By pumpkins	3 00
By manure remaining in the land	8 00
	$117 30

Cost of corn per bushel, fifty-four and two-thirds cents.

HAMPDEN EAST.

[Statement of George E. Tucker & Son of Monson.]

The field of corn which we enter in competition for the premium offered by your society contains two acres and ten rods of sward-land. It was ploughed about six inches deep, harrowed thoroughly with Shares's harrow, after being manured broadcast with about eight cords of stable and hog manure per acre.

It was planted the 24th of May, with a handful of plaster, ashes, and hen-manure mixed in the hill. At the first hoeing it was dusted again with the fertilizer, cultivated both ways, and hoed three times, leaving the field in a clean state of cultivation.

Cost of Crop.

Ploughing	$8 00
Harrowing, and spreading manure	6 00
Furrowing	1 50
Seed-corn	60
Planting	4 00
Cultivating and hoeing	15 00
Harvesting	17 50
Interest on land	6 00

Manure, sixteen cords, one-half to go to land	$32 00
Fertilizer, two loads	6 00
Total	$96 60

Value of Crop.

By weight, 128$\frac{3}{4}$ bushels shelled corn, allowing 70 lbs. on the ear, at 70 cents	$90 12
Three tons of stover	24 00
Twelve cartloads of pumpkins	12 00
Total	$126 12
Balance in favor of crop	29 52

PLYMOUTH.

[From the Supervisors' Report.]

For the Best Experiment in Raising Corn at the Least Cost per Bushel.

	Amount per Acre.	Cost per Bushel.
Rufus A. Littlefield of E. Bridgewater	64$\frac{1}{2}$ bushels.	22$\frac{2}{7}$ cents.
Davis Copeland of W. Bridgewater	60 "	31$\frac{18}{15}$ "
Henry M. Porter of Halifax	37 "	49 "

The difficulties attending the award of these premiums have been greater this year than last, owing to the much greater diversity in the character and previous condition of the land on which the crops are grown, and would have been more troublesome still, had the competition been close, which, luckily, it was not. Mr. Littlefield's piece was near his house; is naturally good corn-land; and, though it has received but little dressing for a number of years, yet evidently it was in good heart, and capable of producing a fair crop without dressing. Mr. Copeland's was rather rough, considerably worn pasture-land; and though, perhaps, the soil might be tolerably strong, and well adapted to the growth of grass, yet it was not what would be called good corn-land. Mr. Porter's was different from either of the others. His was also old pasture, but with a light sandy soil favorable for the growth of white-pine, by which it is nearly surrounded, and had not been ploughed for a great many

years till last year, when a fair crop of rye was grown upon it without manure or dressing. Had the corn preceded the rye, the yield would probably have been larger, and the apparent cost per bushel less. We say apparent, because we do not admit that any one can take a crop of corn from a field without reducing the value of that field, unless he previously applies an equivalent in the shape of dressing of some kind.

Mr. Littlefield and Mr. Copeland both used stable-manure applied in the hill, Mr. Copeland using more than Mr. Littlefield, as, from the character of the soil in the two fields, we should presume he would be obliged to in order to obtain an equal crop. Mr. Porter used guano ploughed under, that method seeming to work well last year; but, the season not having been so dry, it is quite possible he would have done better this year, had he placed it nearer the surface. Mr. Littlefield's corn was remarkably sound, less than one per cent being called pig-corn. His corn was not, however, at the time of harvest as dry, and in as good condition, as either of the other crops. We therefore caused ten pounds of his ears, and also of Mr. Copeland's, to be laid aside for two or three weeks, and then re-weighed. At the second weighing Mr. Littlefield's weighed eight pounds and a half, and Mr. Copeland's nine pounds and a quarter. This test was thought to be a fair one; and, as it agreed very well with our own observation of the two crops, it was decided to make a reduction of seven and a half per cent from the weight of Mr. Littlefield's corn before proceeding to compute the cost per bushel. We have again taken eighty pounds of ears as equivalent to a bushel, or fifty-six pounds, of shelled corn; for, after the reduction mentioned in Mr. Littlefield's, the crops were all in good condition. Mr. Littlefield (after discounting the seven and a half per cent) had 5,164 pounds of ears, equal to sixty-four bushels and a half; Mr. Copeland had 4,800 pounds, equal to sixty bushels; and Mr. Porter had 2,958 pounds, equal to thirty-seven bushels of shelled corn.

With regard to the amount and value of the stover, all three of the competitors cut up and shocked their corn, therefore the fodder is of nearly equal value per ton. Mr. Littlefield and also Mr. Porter tested the weight of the fodder in a

given number of shocks as compared with the weight of the corn. Mr. Littlefield found about an equal weight of each, while Mr. Porter had about thirty-three per cent more fodder than corn. This tends to show, that, the more heavy and sound the corn is, the less in proportion will there be of the fodder; and it appears reasonable that it is so, when we consider that the growth of the fodder is nearly all made before the corn commences to fill, and, consequently, the more full and perfect the ears become, the greater ratio will they sustain to the fodder already grown. After a fair consideration, but without going into small fractions, we have decided to call Mr. Porter's stover two tons, Mr. Copeland's two tons and a half, and Mr. Littlefield's two tons and three-fourths, and to estimate each at seven dollars per ton.

With regard to the manure now remaining in, and the condition of the land for future crops, it is a difficult problem to determine, and give a satisfactory explanation of its solution; and we do not feel like attempting it. We have, however, after careful thought, decided to allow Mr. Copeland for one-third of the manure applied as remaining for the use of future crops, and regard Mr. Littlefield's and Porter's as fully expended. In accordance with the foregoing, we have arranged the following table, which gives a comparative exhibit, and the result of the three crops. All have returned the number of hours of labor performed in the cultivation of these crops, which we have reckoned at twelve cents and a half per hour for a man, ten cents for a horse, and five cents for boy, if one was employed to ride horse, &c.

EXPENSES.	Littlefield.	Copeland.	Porter.
Ploughing	$1 50	$2 44	$1 63
Harrowing	50	33	37
Furrowing or marking	28	45	50
Manure applied ($\frac{6}{8}$ of Copeland's) . .	15 00	17 50	17 05
Planting	1 25	1 88	1 77
Seed	27	27	25
Cultivating	56	90	1 01
Hoeing, and pulling weeds	2 50	2 50	1 25
Cutting up and shocking	1 88	2 50	2 00
Getting into the barn	1 00	2 00	1 50
Harvesting or husking	5 88	6 10	3 60
Taxes, and interest on land	3 00	1 75	1 25
Total cost of crop	$33 62	$38 62	$32 18
Deduct value of fodder	19 25	17 50	14 00
Total cost of corn	$14 37	$21 12	$18 18
Cost per bushel ($64\frac{1}{2}$, 60, 37)	$22\frac{2}{7}$	$35\frac{1}{5}$	49

Mr. Littlefield is entitled to the first, Mr. Copeland the second, and Mr. Porter the third premium.

[Statement of Rufus A. Littlefield of East Bridgewater.]

The acre of land entered by me for the premium on corn produced at the least cost per bushel is a warm, fine, sandy loam, the most of which has been in grass for the last fifteen years, producing about five-eighths of a ton per acre. A few bushels of ashes, perhaps twenty-five, were spread on the poorest part in 1871. In 1874 about thirty rods were planted to fodder-corn with a light dressing in the hill; and in the spring of 1875 a light coat of manure was harrowed in, and Hungarian sowed; and in the fall it was set with blackberry-canes, and thus remained without manure till last spring. May 24 it was ploughed nine inches deep, a part harrowed with a wheel harrow, and the piece furrowed out forty-one inches apart. Two cords of manure from under my horse-stalls were applied in the furrow. It was planted the same day in hills thirty inches apart, putting four corns in each, using ten quarts of corn of a yellow variety which I have been improving for several years, and now consider the most productive kind of yellow corn with which I am

acquainted. The ears are of medium length, well covered at the tip, and the kernels broad and deep.

June 20 I scarified it one way, July 1, the other way, and hoed it July 2. I pulled some weeds Aug. 15. The corn was cut up Sept. 25, and shocked on the 27th. There were a hundred and twelve large shocks, which were hauled to the barn, and husked about Oct. 9. A shock of corn weighing a hundred and one pounds was husked, and gave fifty pounds of ears, leaving about fifty-one pounds of fodder. The entire weight of the crop was 5,583 pounds of ears, fifty-one pounds of which was called pig-corn. Expenses: ploughing, harvesting, and furrowing, two dollars and a quarter; seed and planting, one dollar and twenty cents; manure and applying, fourteen dollars; cultivation, two dollars and a half; harvesting, seven dollars and eight cents; interest and taxes, one dollar and twenty cents; total, twenty-eight dollars and twenty-three cents. I have reckoned ten cents per hour for a man, and also for a horse. I think a third of the value of the manure remains in the land. The stover I consider worth seventeen dollars and a half.

[Statement of Davis Copeland of West Bridgewater.]

The land on which my corn grew is a moist, gravelly loam. Has not been ploughed for twenty-four years: it was then moderately manured, seeded to grass, and mowed for a few years, since then has been pastured, and was now badly worn out. May 28, it was ploughed about six inches deep, harrowed with the Randall harrow, and furrowed one way about three feet apart. May 30 three cords and a half of stable-manure were dropped in the furrow, and the corn planted in hills two feet to two feet and a half apart, using ten quarts of yellow corn. It was horse-hoed and hand-hoed twice, cut and shocked in September, and husked in October. There were forty-eight hundred pounds of ears, three hundred pounds of which were pig-corn. I estimate the stover at three tons to three tons and a half, and worth seven dollars and a half per ton. Expenses: ploughing, harrowing, and furrowing, three dollars and a half; manure and dropping, twenty-seven dollars; seed and planting, one dollar and eighty-seven cents; cultivation, three dollars and a half;

harvesting, eight dollars and sixty cents; total, forty-four dollars and forty-seven cents. I have reckoned twelve cents and a half per hour for a man, and also for a horse.

[Statement of Henry M. Porter of Halifax.]

The land on which I raised my corn has not been ploughed for fifty years. It has been used as a pasture. A number of coal-pits have also been burned upon it. I took off a fair crop of rye last year without any manure. The rye seemed to do better on the pit bottoms. The corn this year has not done so well. The soil is a light sandy loam. Ploughed, May 20, five inches deep; harrowed once, and marked each way three feet and a third apart. Six hundred pounds of guano were sowed on before ploughing. May 21 planted by hand, using nine quarts of yellow corn. Cultivated twice one way, and once the other, and hoed by hand. Cut and shocked Oct. 2, and husked in the latter part of the month. There were 2,958 pounds of corn, three hundred and ninety-seven pounds of which was pig-corn. I think there is about two tons of the stover. Expenses: ploughing, harrowing, and marking, two dollars; manure and applying, seventeen dollars and five cents; seed and planting, two dollars and sixty-five cents; cultivation, two dollars and twenty-six cents; harvesting, six dollars and ninety-five cents; total, thirty dollars and ninety-one cents.

OUR ROOT CROPS.

ESSEX.

THE SUGAR-BEET.

[Statement of William Miller, Swampscott, Mass.]

I had about a quarter of an acre planted with sugar-beets, the production per acre being about forty tons, the average of each bushel seventy pounds. I have grown them for the last five years, and had better crops each year previous to this.

The land I raised them on was a black muck with a clay bottom, the second year from old sod-land of twenty years laying sour until drained. I planted the first week in May, with stable-manure and guano,—six cords per acre, with one-quarter ton per acre of guano. The drills were raised on account of low, wet land. I have always succeeded best with the raised-drill system on low land. I have never failed in getting a good crop of sugar-beets.

I have invariably succeeded best with all kinds of vegetables, except perishable seeds, to plant early, close to the seashore as we are situated. My employer gives very liberal encouragement to farm well; for we let no weeds grow to take the nourishment away from the plants. Weeds, in my estimation, are the worst enemy a farmer has to contend with. We mowed four tons and a half to the acre on land that grew nothing but wild meadow-grass before it was under-drained, then cropped with vegetables for two successive years, then laid down to grass before the ground froze in the end of November.

The underdraining was done with hemlock boards — one board seven inches wide, and another eight inches wide — nailed together ∧ shape, with no bottom; as it was a hard

clay bottom, with a few small rocks on each side, so that the water would filter in. The drain did not average two feet deep on account of the little fall I had. I prefer boards to tile on account of frost. The cost of hemlock boards is ten dollars per thousand feet. They have been proved to last underground twenty-five years. I have found them to work admirably so far. I drained about four acres this way. The land before drained grew nothing but wild swamp-grass, and now about four tons and a half to the acre of splendid herd's-grass and red clover.

We raise sugar-beets solely for cows, and I consider them very valuable compared with the coarse mangolds. The amount of milk is much larger, and of better quality as I have proved.

I have not had them analyzed for sugar, but should think the percentage was larger than I saw stated in "The Massachusetts Ploughman" of last week, as an average; for they are solid, close-grained, and very sweet, the *pure* article, which I am happy to say I have always had.

I have been very successful in improving old sod-land of twenty-five years down, by ploughing deep in October, and laying down to grass again just before the ground freezes up, late in November, so that the seed will not germinate before spring. I think it is as good as cropping it with culinary vegetables, sapping the ground again, and encouraging weeds.

It is a little more work to grade it down right. My system, after ploughing, is to manure with barnyard-manure (six cords to the acre) wheel-harrowed in; then brush-harrow the seed, so that the grass gets the best of the weeds before the warm weather of the next summer. I have raised four tons to the acre by following this way. I consider the old sod I turned down after rotting is a pretty good manure of itself. I think top-dressing old sod-land with barnyard-manure is almost like throwing money away, compared with working in the manure after ploughing. After the ground is down a year, a top-dressing of sea-manure works splendidly, especially on low land; the more wet on the surface, the better for it.

I prefer horse and cow manure mixed, if the animals are grained well, which makes the good ingredients.

I may say the board drain is very simple to make. Hemlock plank would be better than boards, in some cases, especially if there is heavy teaming over it. Using plank, they need not be so wide, and the cost would be but a little more. Only a few nails are required to keep the tops in place, a little opening being left all the better. I am sure such drains will give satisfaction in low land where you cannot go deep. The distance of the drains apart is fifty feet.

HAMPSHIRE, FRANKLIN, AND HAMPDEN.

[Statement of James Porter of Hatfield.]

The land on which the beets that I offer for premium were raised has been used for cultivated crops for several years,—broom-corn, potatoes, Indian-corn,—and had not been enriched like most of the tobacco-fields. The amount of barn-manure used was twelve two-horse loads, which was ploughed in in the fore part of May. I used at different times during the season eight hundred pounds of Stockbridge beet-fertilizer. The land was ploughed one inch deeper than it had been before, rolled, and well harrowed, and was sown near the middle of May, using ten pounds and a half of seed furnished by Mr. Lincoln. I used in sowing the seed the Woodward corn-planter. With the same machine I distributed in the rows, which were twenty-six inches apart, four hundred and fifty pounds of the best fertilizer, it being previously mixed with about the same quantity of dry earth.

The beets not coming up as evenly as desired, two persons spent one day in transplanting, which was done the 17th of June. Immediately after, they were thinned so as to stand from five to eight inches apart. The beets were cultivated twice, and hoed three times. About the 25th of June I applied some fertilizer on one-third part of the piece, scattering it near the row, and cultivating it in the soil. The result was a larger growth of top than root. Near the 1st of August I used one bag of fertilizer on one-fourth part of the piece in a different place from that of June 25, and had a heavy crop of the root. I commenced harvesting the 23d of October, weighing each load. The weight of beets on one acre amounting to 51,632 pounds.

Cost.

Ploughing	$1 50	
Carting and spreading twelve loads manure	4 00	
Rolling and harrowing	1 00	
Sowing	1 25	
Applying fertilizer at different times	1 50	
Hoeing, transplanting, and thinning (fifteen days)	18 75	
Horse for cultivating	75	
Time spent in harvesting (thirteen days and a quarter)	13 25	
Use of team in harvesting	3 00	
		$45 00
Value of twelve loads manure	$20 00	
Eight hundred pounds beet-fertilizer	20 00	
		40 00
		$85 00

[Statement of Amos Sawyer.]

The land on which the sugar-beets were raised was in very poor condition, but manured heavily with barnyard-manure. The beets were hoed three times, and thinned out the second hoeing. I fed them to my hogs in a raw state, and recommend them highly for that purpose. The acre entered for a premium produced 45,835 pounds of beets.

Analysis.

	Per cent.
Marrow	4.02
Soluble in water	12.23
Water	83.75
	100.00

Juice.

	Per cent.
Sugar	9.70
Water	87.87
Ash	.86
Organic non-sugar	1.57
	100.00

[Statement of H. C. Comins.]

The land is river-soil, fine loam. In 1878 a part of it was in tobacco, a part in sorghum, and a part in roots, all well manured with stable-manure. This year it was ploughed about eight inches deep, thoroughly harrowed, and the fer-

tilizer applied broadcast,—six bags (thirty dollars' worth) of Stockbridge fertilizer, and no other. The land was ridged about two feet and a half apart, and the seed sown upon the ridge with a Harrington seed-sower about the 20th of May. They were cultivated with a horse four times, and hoed three times after cultivating.

Cost.

Ploughing land	$1 50
Harrowing and crushing	1 00
Ridging	50
Sowing	50
Seed, ten pounds, twenty cents per pound	2 00
Cultivating four times[1]	2 00
Hoeing three times[1]	4 50
Weeding and thinning	1 60
Harvesting	7 00
Labor	$20 60
Fertilizer	30 00
	$50 60

Analysis.

	Per cent.
Marrow	4.02
In water soluble	13.13
Water	82.85
	100.00

Juice.

	Per cent.
Sugar	12.00
Water	86.33
Ash	.78
Organic non-sugar	.89
	100 00

[Statement of P. Stedman & Son.]

Our crop of sugar-beets was grown upon one hundred and ten rods of ground. Perhaps we can best describe the soil upon which they were grown by saying it is of medium texture for Connecticut-river land in this vicinity, being less sandy than that lying near the bank of the river, yet more friable than is most of that lying farthest from it. Previous crops were grass in 1876, and some years previous; 1877

[1] The exact amount paid, as it was hired.

and 1878, corn, with stable-manure applied broadcast after ploughing; 1879, ploughed and harrowed, then opened drills three feet apart, with a light furrowing plough. Unrotted manure from the barn-cellar was put in the drills at the rate of about eight cords per acre. Manure was covered with the ridger, and seed sown upon the ridge with the Harrington seed-sower, at the rate of seven pounds per acre.

The seed-bed being some two inches higher than the general surface of the field rendered the first hoeing very easy; it being simply to pass the hoe slightly upon each side of the row, the loose earth inclining from the row, so that there was no covering or choking of the tender plants. A large proportion of these had not at this time appeared above the surface. Neither had *weeds* appeared in any considerable force. We feel assured that this slight hoeing, which occupied one man less than a day, together with the cultivating that preceded it, secured for both us and the beets an easy victory.

After about ten days, when the plants were well started, they were again cultivated and hoed. This hoeing was more thorough than the first, and required the labor of one man two days. Besides drawing the hoe parallel with the row, it was drawn across it, leaving uncut a narrow space once in about eight inches. The last of June they were again hoed, thinned, and weeded. This required two days' work and a half. After this they were twice cultivated, and once hoed to the extent of one day's work. This comprises all the labor until harvest.

In harvesting, we clasp the tops and raise the beet with one hand, with the other hand take hold of the root; then, turning the hands in opposite directions, the top is easily taken off, and the root is dropped in rows, with space between the rows sufficient to allow the cart or wagon to pass. We store the roots in a pit near the barn. This we make by digging a trench four feet in width, and a foot and a half in depth, throwing the earth upon each side. We find it most convenient to dig the pit in sections, filling with the roots as we advance. In this way they are dumped in place, so that the only handling required is to crown the pit, carrying to a point; making the entire depth of roots at the centre four feet.

The cost of this crop and its value stand very nearly in accordance with the figures below: —

Ploughing and harrowing	$2 00
Carting manure (man and horse two days)	4 00
Furrowing and covering manure	1 00
Seed (six pounds) one dollar and twenty cents; sowing fifty cents	1 70
Hoeing six days and a half	6 50
Cultivating five times	2 00
Manure (five cords and a half at six dollars)	33 00
Harvesting (six days and a half), digging, and covering, pit included	6 50
Interest on land at a hundred and fifty dollars per acre	6 18
Taxes	1 50
Total expense	$64 38

Cr.

By 16 45-100 tons beets at five dollars (gross)	$82 25
One-third value of manure for future crops	11 00
	$93 25
Balance to credit of crop	$28 87

This is at the rate of $41.99 per acre, and is equal to 53.597 pounds to the acre.

[Statement of James Ellsworth.]

I treated the field of sugar-beets grown by myself substantially as follows: —

The land had one ploughing to the depth of eight inches, at least. I thoroughly harrowed it, and marked out the rows twenty-four inches apart with a double mole-board, one-horse plough. I scattered in these furrows Thompson & Edward's Chicago Animal Guano, at the rate of seventeen hundred pounds per acre. I ridged over the fertilizer by passing the same plough, used for marking, between every two consecutive rows or furrows, thus making the seed-bed or ridge. The seed was dropped from a Harrington machine. The crop was hoed three times, and thinned out the second hoeing.

I think that one-fifth of the growth was lost by the too powerful action of the guano. One half of the quantity used should have been sowed broadcast, and harrowed in, and the other half applied as I used the whole.

It would be proper for me to state here that no stable-manure has been put upon the field for three years, and it has been cropped every year.

Analysis.

	Per cent.
Marrow	4.02
In water soluble	13.58
Water	82.40
	100.00

Juice.

	Per cent.
Sugar	13.00
Water	85.50
Ash	.77
Non-sugar	.73
	100.00

HAMPSHIRE.

[Statement of L. O. Chittenden.]

The land consisted of a quarter of an acre good sandy loam.

In the summer of 1875 it was mowed early, the turf turned under, and cropped with tobacco, manured with Stockbridge fertilizer.

Last spring the turf was turned under, the soil thoroughly pulverized with wheel harrow, and manured lightly with barnyard-manure and about a hundred and fifty pounds of Bradley's X. L. phosphate sown broadcast and harrowed in.

In this condition I think the land would bear about forty bushels of corn per acre.

The beet-seed used was from the last imported by Mr. Lincoln of Boston, and sown on or about the 15th of May, in drills eighteen inches apart. The plants were thinned to stand from four to six inches apart.

The field was kept clear of weeds, the soil being drawn up around the plants as much as possible.

The crop was harvested the 29th of October.

I took two rods, one on each side of the piece: on the first I had four hundred and thirty-two pounds, on the second three hundred and seventy-three pounds of roots.

Taking the average of these, it gives me four hundred and two pounds and a half to the rod, or sixty-four thousand four hundred pounds per acre, equal to thirty-two tons and a tenth.

The beets were analyzed at the Agricultural College laboratory, and gave from 10.30 per cent to 11.18 per cent sugar.

[From an Essay on Root-Crops by J. L. Delano.]

Fifty years ago the people of this section did not pay much attention to root-crops any farther than to supply a few edible varieties for the use of the family. The live-stock in the barn scarcely ever got any thing of the kind from Thanksgiving till May; and the young stock and dry cows, being kept almost exclusively on swamp-hay and cornstalks, suffered acordingly, and came out in the spring poor, scrawny, and hide-bound, with their bowels in the condition to justify the Vermont farmer when he says, "as tight as a yearling steer in the month of March." It is true, here and there would be found a farmer who would raise some English turnips; but most farmers had the idea that they poisoned the land, and in some way rendered it unfit for any other crop for a year or two afterwards.

But, during the last ten or twenty years, a general revolution has taken place in regard to root-crops, not only in our vicinity, but all over the State; and those of our farmers who have learned to grow them with economy of land and labor have long since abandoned all doubts with regard to their profit, and fully appreciate the benefits they confer on the animals which consume them; and they are now so generally grown in some parts of New England, that it is evident that they are beginning to be appreciated somewhat according to their value. If the keeping and feeding of live-stock upon our farms is the basis upon which successful agriculture must rest, and the health of animals, and the capacity to digest other kinds of food, is largely promoted by the liberal use of roots, aside from the actual nourishment they contain, and the amount of other and more expensive food that may be saved, then the importance of root-culture is firmly established.

In this connection it is well to remember that three tons

of roots are equal to one ton of hay, or, in other words, one ton of hay and three tons of roots are equivalent to two tons of hay when fed to milch cows. This fact has been demonstrated over and over again, and is accepted and acknowledged by many who till lately were sceptics in regard to their worth. Then, when we consider the enormous weight — say, from twenty-five to fifty tons — that can be raised on an acre, compared with the weight of hay raised on the same acre of land, it is evident at once that economy will soon follow where science and health now lead the way.

I have had experience in cultivating only a few of the many kinds of roots, and therefore I will go into details in the mode of culture of only those few, leaving to others who have had experience with others to give us their opinion in relation to each. And first let me call attention to

THE TURNIP.

The turnip will grow on all varieties of soil; but the flat varieties succeed best on sandy or light loam, while the ruta-bagas, or Swedes, like a heavier one. The "purple-top strap-leaf" has given me the most satisfaction of any of the late kinds that I have tried, and I think it the best to sow after pease, early potatoes, or other first crops, are off the ground. Some may question the idea of sowing the Swedish turnip in rows, where it shall stand till it matures. I know it is more work to raise them this way than to transplant; but you get a great deal better article.

In regard to getting turnips too thick: if you use a machine to sow them with, and it invariably puts in about twice as much seed as you would wish to have grow, and so makes a great deal of labor in thinning, it is easy to take your seed, and divide it into two equal parts, and then scald one-half of it, so as to kill the germinating power, and then, after thoroughly re-mixing it, sow as usual. It is cheaper to waste half of the seed than to get down on your knees, and pull it out after it gets up. Turnips may be nearly all water; but there is something in them that is really beneficial to young stock, dry cows, colts, and horses. I would not feed turnips to cows giving milk; for we can get something so much *better for them* at so slight advance in cost, that the balance goes over the other way.

CARROTS.

We raise carrots to color butter with, and to feed to milch cows. For butter-coloring, raise the "early scarlet-horn:" for stock, raise the "long orange." Don't let your carrots stand too thick in the row. Five or six inches is near enough. I remember going into a neighbor's field of carrots last summer, and found them standing only two or three inches apart in the row; and in the fall he was ready with the remark that "it was a poor year for carrots." If we can raise carrots, and sell them to the livery-stable keepers for fifteen dollars per ton, I think it would be a good crop; but I would not raise them to feed to my cows, or to the horses we work on our farms. It is an expensive crop to raise, and is actually no better for cows than beets, and not so good as turnips for working horses.

Carrot-seed is one of the weakest germinating of all seeds, slow to sprout, and hard to see or find after it gets above the surface of the ground. For this reason, a larger quantity of seed should be sown than is necessary for the crop: so that it may be strong enough to raise itself through the earth, and stand erect above it; and I have practised for two years sowing a little radish-seed with the carrot-seed, and then you don't have any difficulty in finding the rows, and it assists greatly in weeding to be able to do this easily and readily.

RADISHES.

Prepare the bed as for onions, making the soil as smooth and fine as possible with your rake and fork; then sow the radish-seed broadcast, and rake and roll it in. After they get up two inches high, attend to the thinning, if necessary, and they will need no further care till they are ready to pull, — about six or seven weeks from the time of sowing. Some strong commercial fertilizer should be used for radishes instead of stable-manure; but it must not be applied too plentifully. Radishes are very profitable when raised near market. A gentleman who raises for Springfield market told me that last spring's radish-crop was the most profitable of any he raised during the vegetable season.

PARSNIPS.

Parsnips are excellent for the table, and are not valued as highly as they deserve for horses and cattle. They are much easier raised than carrots, because the tops get size sooner; and they will keep in the ground till spring better than any other root grown, unless it is horseradish.

The Jersey cows in their native land were fed largely on parsnips; and many of the breeders attribute in a great degree the good qualities of the breed to judicious feeding of parsnips while the animals were young.

A loamy soil, highly manured, deeply ploughed, and rather moist, is most desirable; though I have seen in the deep muck-bed of the famous Green Swamp, on yonder mountain, some of the largest and handsomest parsnips ever grown, some of which measured fourteen inches in circumference, and were over two feet in length.

ONIONS.

I don't know that I have any thing new to offer in regard to onions, except that I am more and more decided that either *well-fermented* manure or Stockbridge fertilizers should be used for the crop on the same land year after year. I was *surprised* to see some of our farmers last spring harrowing in coarse stable and hog manure for onions. It increased the labor of raking the ground over very much, and the late weeds were doubly troublesome in such pieces. If manure *is* used, let it be well rotted, and fermented, if possible, till the seeds of weeds are killed, and the manure well decomposed. Again: the fly and maggot, which so seriously cut down our onions, are identical with the fly and maggot we find with our unfermented manure, and I have a vague suspicion that in some way they are connected in their depredations on both manure and onions.

BEETS.

Beets are attracting more attention than formerly, and justly too; for improvements have been made in their quality and productiveness. The Early Bassano is considered the best for early marketing, or for the table, to be followed by the Egyptian and Long Blood in their proper courses. The

latter is preferable for winter use, because it keeps better, and produces more in quantity; but, for stock-feeding, either mangolds or sugar-beets are now preferred to all others. Personally I consider the sugar-beet superior to the mangold; for, while we get less in quantity, it is much better in quality. It is sweeter, and contains more nutrition. "Lane's American improved imperial" is largely raised in the Connecticut Valley, and is generally regarded as the best. The average weight is about six pounds; though it sometimes attains an enormous size. The originator of this variety has grown specimens that weighed twenty pounds each, showing that it is more of a mangold than a sugar-beet.

Beet-seed for stock-feeding should be sown about the middle of May. Plough in half of the manure; put the rest in furrows two feet and a half apart, and cover it with a tobacco-ridger. Then sow the seed at the rate of four pounds an acre. Thin the plants when the root is as large as your finger, leaving them eight or ten inches apart in the rows. Keep the weeds down, and run the cultivator often between the rows. If you should get short for green fodder for your cows in October, pull off the tops of the beets, and feed *them*. The beets will do just as well, and sometimes seem to keep better in winter, if this is done; for the crown of the beet will get somewhat healed over before it is put into the cellar, and it does not rot so soon. Cows that are in milk during the winter, eating one peck of roots a day, will eat no less hay, but will look better, although it is a small quantity to feed. When I have plenty of roots, I feed from half a bushel to a bushel a day, and always with good results.

There is a great variety of vegetables from which the farmer should select a few, at least, for his own family use. It is economical, it is healthy, it is always convenient, to have a good supply of vegetables on hand. I cannot speak of them all, were I disposed to so do; but I cannot close without saying a few words in regard to

POTATOES.

Formerly we thought any piece of ground, at the end of the corn-rows, or on some poor spot of land where nothing else would succeed, was good enough for potatoes. But the

Colorado potato-bug has taught us to prize what before we despised. We must cultivate less ground in potatoes, but do better by them both as regards fertilization and personal attention. The seed is of great importance. Some of the new varieties that have been produced within the last fifteen years are better than any of the old ones. Last year I obtained some seed of the Burbank potato, sent out by Gregory, and planted it side by side with the Brigham seedling; and it yielded, with exactly the same treatment, one-third more, and of a better quality, taking the first premium at the show at Amherst. The Early Rose is a first-rate potato, but don't stick to the Early Rose too long. Get the best seed, and *take some pains* to get the best. The Snowflake and Peerless are highly esteemed by many; and the seed of these two kinds can be obtained quite easily in this vicinity. Nearly every farmer has *his way* to plant potatoes. I furrow out my land three feet apart, put the manure in the furrow, cut my potatoes down to two eyes, drop the pieces of seed one foot apart in the rows, and cover deep with the ridger. When the sprouts get up, take a common square harrow, and run it lengthwise in the rows. This kills all the weeds, and levels down the ridges somewhat, does not hurt the potato at all, and makes one hoeing less than by the old-fashioned way.

Paris green is the best remedy for the bugs. Hand-picking is good; but it must be done every day, all the time, continually. But you can put on the green, and then go about your business; and then, in a week or so, when you see the bugs begin to appear again, put on another dose, and so on. The great difficulty, I believe, is, that we have neglected putting it on soon enough, and then have put on *too much*. As soon as you find a few bugs on your piece, apply the poison. Don't wait until they have got well at the vines, and you can see that they are actually injuring them, but attend to it in season. I found, last summer, that a quarter of a pound to a half-acre, for each application, was just as good as a pound, and *better;* for the larger quantity is a damage to the vines, and causes them to look as though they were blasted.

NUTRITIVE VALUE OF ROOTS.

HAMPSHIRE.

[From an Essay by H. E. Stockbridge.]

I shall briefly examine the subject by the light of a few scientific facts, and endeavor to draw such practical conclusions as are suggested. And if I devote space to the consideration of the so-called root crops, to the exclusion of vegetables, it is because the latter are grown principally for human consumption, to be sold from the farm, and for them there is a constant demand to which the farmer has simply to cater; while on the other hand roots are generally grown for consumption on the farm, and it is of vast importance that we ascertain, if possible, which of them can be most profitably converted into animal tissues and animal products, or will in the greatest degree increase the power of the animal for taking nutriment from its other food. In considering the question, we must first fully understand the object or objects of root-growing.

Writers on the subject have stated that the value of all food was solely in the nutrition it contained, and have endeavored to figure out its value in different articles of diet, simply from the amount of the nutritive elements found in them; yet every farmer knows, that, during its winter confinement, his stock is in an unnatural condition; that animals thrive best when fed upon green food containing more than eighty per cent of water; and that the roots given them have two very important offices, — first to supply the nutrition contained in themselves, and, second, to keep the animal in as natural a condition as possible, and thus enable it to extract more nutriment from its other food.

All root-crops contain about the same quantity of water, and therefore all answer equally well the second purpose for

which they are fed. Therefore, in determining which crop furnishes the most nutrition in exchange for the cost of production, we have to deal only with the nutritive qualities, or flesh and fat producing properties, of the various crops. And, for the sake of convenience, I have prepared a table showing the relative flesh and fat forming qualities of our most commonly cultivated roots. Though my results differ somewhat from quite generally received statements, I believe they are, so far as is at present possible, perfectly correct; for the calculations are original, and the analyses upon which they are based were derived from foreign sources, and have never before appeared in English.

The most reliable chemical analysis of the important root-crops gives the following results: —

Total Amount of Nitrogenous or *Flesh-forming* Material.	Pounds.
In 1,000 pounds of potatoes	20.3
In 1,000 pounds of mangolds	11.25
In 1,000 pounds of sugar-beets	10.00
In 1,000 pounds of turnips	11.25
In 1,000 pounds of carrots	13.12

Total Amount of Carbonaceous or *Fat-producing* Material.	Pounds.
In 1,000 pounds of potatoes	237.4
In 1,000 pounds of mangolds	107.2
In 1,000 pounds of sugar-beets	174.4
In 1,000 pounds of turnips	81.7
In 1,000 pounds of carrots	139.1

By a comparison of these figures, it will be seen, that, as a flesh-producer, the potato stands first; while the sugar-beet comes last, containing rather less than half the amount of nitrogenous matter found in the former. As producers of fat, potatoes stand first, closely followed by carrots and beets, while turnips and mangolds are far in the rear. It therefore appears, that, were the nutritive qualities of roots the only basis for our decision, potatoes would be pre-eminently the best root-food for all classes of animals, and that next to them stands the frequently despised carrot. But there is an item in guiding to the selection of the best root crop, if possible, of far more importance than the amount of beef and fat forming elements it contains; namely, the cost of produc-

tion, and hence the market-value per pound of the nutriment they furnish. Experience has fully demonstrated, that, in regard to its yield, the ease with which it is cultivated, and its freedom from disease and insect-pests, the sugar-beet far surpasses all other roots; and when it is taken into consideration that in nutritive qualities it is only surpassed by the potato and carrot, both of which are greatly inferior to it as producers, and far exceed it in the cost of cultivation, it must be conceded that the sugar-beet is, all in all, much the most profitable root we can grow, and is suitable alike for young growing animals, fat cattle, horses, milch cows; and even sheep and swine might advantageously be treated to an occasional meal of these palatable and nutritious vegetables.

Having stated what, to the best of my knowledge, is the most profitable root-crop to grow, let me make a few suggestions with regard to the cultivation and use of roots. And first bear in mind that a hundred and fifty pounds of beet-tops are equal, for fall feeding, to a hundred pounds of the best meadow-hay. There is a great difference between growing beets for sugar, and beets for cattle: in the former case it is the chief aim of the producer to exclude all the nitrogen possible; while, in the latter, it is desirable that the plant store up the largest possible amount of this element.

Therefore beets for feeding-purposes should be grown on heavier land, or that containing more organic matter, and given all the nitrogenous food they will assimilate.

Notwithstanding opinions to the contrary, I do not believe in cooking roots for horned cattle. The animals relish the raw vegetables best. The amount of woody fibre is so small, and the elements of nutrition are all so soluble, and readily taken up by the system, that the increased nutritive qualities of the food, if they exist, will not nearly compensate for the increased cost of feeding. An acre of land that will produce three tons of hay will grow twenty tons of beets; and when it is remembered that three hundred pounds of sugar-beets are the nutritive equivalent for one hundred pounds of meadow-hay, it will be seen that an acre of beets furnishes more than twice as much nourishment as does an acre of hay, and that the nutriment furnished by them is in the cheapest possible form. But, as it is not natural for the animal to take the bulk of its food in this condition, it

thrives best when receiving a portion in the form of hay or fodder Aside from the nutriment they contain, the effect of roots on the condition of the animal is so salutary, that this alone would repay the farmer for never attempting to winter his stock without roots sufficient to supply his animals with frequent meals of from one to three pecks of cut roots each. And, if such an allowance was given them every day, their owner would be amply rewarded.

Though I fear the statement conflicts with some generally received ideas, I am convinced, that, if not carried to excess, roots are the most profitable winter food for cattle; that among them the sugar-beet stands first; next to it comes the mangel-wurzel; and for feeding-purposes the potato, even were it not visited by blight, rot, or Colorado beetle, could never be profitably grown. It is a fact beyond controversy, that the most successful agricultural districts are those where the most attention is given to these products. Though our farmers are giving the subject more thought every year, I believe that a vastly increased acreage is essential to their greatest success, and that the cultivation of this crop is a necessary accompaniment to high and successful farming.

GARDEN VEGETABLES.

ESSEX.

[Statement of Aaron Low of Essex.]

The soil on which most of our vegetables are raised, particularly those varieties for early use and marketing, is a warm loam, which appears best adapted for early pease, beets, cabbages, potatoes, and sweet-corn. We depend mostly on stable-manure, but use considerable fish-guano, Stockbridge manure, and Darling's bone. We manure liberally, as we follow all of our early crops with a second planting, either of squashes, cucumbers, or cabbages. The past season I planted among our early pease and potatoes my new hybrid squash, planting the seed between the rows after the last hoeing, from the 25th of June to July 4, putting a shovelful of stable-manure to each hill, and hills about eight feet apart each way. I cultivated and hoed them twice, and, as a guard against bugs, sprinkled the plants as soon as up with flour of plaster. In planting so late in the season, we escape the worm that destroys the roots of the vines.

The squashes — coming up very quickly, and growing rapidly — soon cover the ground, and keep down many weeds that would otherwise be troublesome. This new variety appears well adapted for late planting, as it matures very quickly (producing the past season, in two months from the planting of the seed, squashes weighing twelve pounds, and well ripened), is very productive, of good quality, and an excellent keeper, specimens of last year keeping till June 10. We keep our squashes in as cool, dry a place as we can without injury from frost. The results of the two crops to the acre would be, I think, if the three varieties of potatoes planted are Clark's No. 1, Beauty of Hebron, and Early

Rose, two hundred bushels, and from eight to ten tons of squashes.

I think that it is quite an advantage to follow an early crop with a second, as it can be produced with much less labor, and, in my experience, fully as large a product as if only the first crop were obtained. Of course, the land must have an extra amount of manure applied to perfect both crops; but the extra cultivation given leaves it free from weeds, and in better condition for the next year.

[Statement of E. P. Richardson of Lawrence.]

From some experiments with phosphates in growing potatoes this season, I am satisfied, that, under some conditions at least, they are profitable, largely increasing the yield, and producing remarkably smooth, handsome potatoes, the excellent quality being noticed by all who had them. On different land and under different conditions, they might not do as well; and, from one or two instances which have come to my notice, I have doubts as to their profitable use again on the same land.

In one instance, on pasture-land (soil, yellow loam, that had borne a crop of corn) which was manured moderately with stable-manure, medium-sized Early Rose, cut once lengthwise, were planted with Bowker's hill and drill and with Bradley's phosphate. Several rows of such were carefully measured, the potatoes weighed, and the average taken, also a row which was planted without fertilizer or manure of any kind. The yield in bushels was at the following rate per acre: —

	Large.	Small.	Total.
No manure	131	56	187
Phosphates	213	74	287

A gain of a hundred bushels per acre, and, of marketable potatoes, eighty-two bushels. None but good sized were classed as large, all less than medium as small, more going with the small than is customary, I think.

I find that the Ohio and Burbank yield better than the

Early Rose, and rot much less, the latter being scarcely affected. On a piece of new land where these varieties were planted, the result was as follows, somewhat less care being taken in measuring, the potatoes not being weighed. Very few were small.

	Ohio.	Burbank.	Early Rose.
No manure	139	–	–
Guano	186	250	–
Phosphate (Bradley's) . . .	302	318	236

[Statement of E. F. Webster of Haverhill.]

In regard to the raising of beans, I find they do much better to plough the manure in in the early spring, and plant from the 20th of May to the 20th of June. Our soil is all the way from gravelly to dark loam. Subsoil is usually loamy, with exception of clay.

Our Lima beans we plant from the 10th to the 15th of June, in the richest and best soil we have. They do best to plant after the land gets well warmed with the sun, and the soil well mellowed; then put in the seed, with a little superphosphate or bone-meal guano in the hill. After the beans commence to run, pinch off the runners, head them in, and you will get more beans from the same quantity of seed. As to my seed, I raised all I planted the past year, except one kind, that was the Rhode-Island Butter, which is a very good market-bean, and worthy of cultivation.

We prepare our land the same as for corn, as beans need good soil, and very much the same cultivation. In growing, cultivate with horse-hoe. Have not been troubled with bugs or insects, as we keep a flock of chickens in our garden and the field. Are troubled some with blight; do not know any particular remedy for it, but to plant again the same ground if not too late in the season. Have planted the Agricultural as late as the 21st of June, with good success. We harvest for market, first, green for stringing, next, green for shelling; we then pull and stack for late. Our early beans we pull, place in piles, and take them to the barn, and thrash them with a common flail. We do not shell any by hand, as it is too much labor.

The most profitable kinds for market of the bush wax varieties are Ferry's Golden Wax and the White Wax; but that is a poor bearer, not so good as the Golden Wax. Of other sorts than Ferry's, the Six-Weeks, White Valentine, and Bush Horticultural are also good market varieties. Of *pole-beans*, the London Horticultural and White Horticultural, for string in the pod; for our own table, the Round White Wax.

The Marblehead Champion is very early for a pole-bean, but not profitable for market. It was first sent out by Mr. Gregory; but I find it is not worthy of cultivation as far as I have tried it.

For *dry use* we like the Dutch Case-Knife; for baking, London Horticultural, both bush and pole. The Pea Bean White is good, but no better than the Yellow Eye (bush). Have not tested the Rhode-Island Butter fully yet; as to its merits can speak more fully after another year's trial.

The other vegetables I raise are turnips, pease, and mangolds. The common turnip-beet does best with manure ploughed in in the fall, and spread and harrow in fine manure in the spring.

DAIRY COWS.

ESSEX.

[From the Report of the Committee.]

A writer in a recent publication, the "Nation," says that "Every one of our agricultural products, with the single exception of Indian corn, is surpassed in value by our dairy yield. The value of the cows, and of the land especially devoted to their support, is reckoned at one billion three hundred million dollars. The annual production of cheese is estimated at three hundred and fifty million pounds, and that of butter at one billion five hundred million pounds. Their combined value, estimated at three hundred and fifty million dollars, is only one-fifth less than that of the corn-crop. The production has increased thirty-three per cent within the past year; and, since the introduction of the American factory system in the manufacture of them, they have become important objects of export, the foreign sales amounting, during the last season, to thirteen million dollars for butter, and fourteen million dollars for cheese. The exportations this year have paid more than a million dollars freight, or enough to support a weekly line of steamers to Europe. They have paid five million dollars freight to the railroads of the country, and milk pays nearly as much more."

No cow is worthy of belonging to the royal family, who does not yield at least two thousand quarts of milk in a year. If this were only true of all, the above figures would be largely increased.

What we wish to show is, that, at present prices, it does not pay to keep a cow that gives less milk than the quantity mentioned; and we believe, with the present abundance of improved breeds of cattle, there is no excuse for keeping a

poor animal. Many pure-breds can now be purchased at prices very little above that of common stock; so that the cost should not stand in the way of any one really wishing to improve his herd. To show the absolute need of improvement, we would state, that, according to statistics prepared a few years ago, the average in New-York dairies was thirteen hundred quarts per cow, and in the *best* dairies only eighteen hundred quarts. Two thousand quarts is a fair yield; but is it sufficient, at present prices, to leave any profit after the keep, &c., has been deducted?

The farmer who sells his milk at the door, or delivers it to the contractor on the cars, gets from two to three cents per quart. Will a cow yielding two thousand quarts per year pay for her keep at these prices? We think not. This brings us to the cost of keeping a cow. Reckoning seven months at six dollars, and five months at three dollars, for feed (a low estimate where milk is the object), we have fifty-seven dollars for the year. A thousand quarts at two cents and a half, and a thousand quarts at three cents, equal to fifty-five dollars: there is no profit. Consequently, it is evident that the quantity of milk must be increased, or the price must be raised, to leave any margin or profit. If you increase the yield to twenty-five hundred quarts per year, its value will be sixty-eight dollars and seventy-five cents, a profit of eleven dollars and seventy-five cents. Unless the farmer has the means of sending his milk direct to market, we imagine he will find it easier to increase the yield than to advance the price.

Butter. — Would there be more money in making butter or cheese than in selling milk at these prices? Let us see. Two thousand quarts, allowing twelve quarts to the pound, would produce, say, a hundred and sixty-seven pounds of butter, which, at thirty cents, would come to fifty dollars and ten cents: deducting five cents per pound for making and marketing leaves forty-one dollars and seventy-five cents. Then we have the skim-milk: the latter is valuable, if fed on the farm, and tends to prevent exhaustion of soil.

Cheese. — Two thousand quarts of milk, allowing four quarts and a half to the pound, would produce four hundred and forty-four pounds of cheese, which, at ten cents per pound, would be forty-four dollars and forty cents, less cost

of making, &c. (two cents and a half per pound) leaves only thirty-three dollars and thirty cents and the whey. If the above figures are correct, they would seem to prove conclusively that milk at even two cents and a half per quart for the whole year would give the producer more money than either butter or cheese. We are aware that many dairies receive more than thirty cents per pound for butter; but we also know that many more receive less.

While every effort should be made to increase the yield of the herd, there is a way by adopting which the price of milk could be legitimately raised, to the great benefit of all concerned; that is, the bringing of the producer into direct communication with the consumer. How can this be brought about? In two ways; namely, either individually to send the milk direct to market, or enter into an agreement with other parties with similar interests, and accomplish the same object by united efforts.

The first method has the merit of independence, and can, perhaps, be managed as economically as the last, where large quantities of milk can be made on a farm. The last method is especially adapted to farmers keeping fewer cows, who thus, by united action, are able to stand on the same level as the larger farmers. In this way co-operation would give an opportunity of selling milk, which otherwise would be beyond the reach of many. Co-operative milk-selling is not a new thing. The Aylesbury Milk Company of England, and the Rockland Milk Company of New York, are good examples of what may be accomplished.

"It is only by a union of interests and action that the producers of milk can expect to become successful milk-sellers. Already we hear of individual effort acting with insufficient information, and really in competition with those who are working under a similar line of policy. It would seem more business-like for such producers as wish to sell their milk direct to city consumers to join some efficient organization, and pull together. In this connection we learn that the United Society of Milk-Sellers, with C. W. Felt of Northborough as manager, is now fairly in operation, and with prospect of a large business. The aim of this society is to sell milk direct from producer to consumer, and to reduce the cost of transportation."

At Quakertown, Bucks County, Penn., the dairymen lately became so disgusted with the price of milk sent to milkmen

in Philadelphia (it having fallen to two cents per quart delivered), that they met, and formed a dairy association, with a capital of four thousand dollars, and built a creamery of the most approved form. We do not at this time propose to enter into a discussion of the merits of co-operative cheese and butter making, which has resulted in the establishment of a large number of factories all over the country, and has added so much to the wealth of the farming community, but shall confine our atttention more particularly to the milk question.

A law passed by our last Legislature provides that all railroad corporations shall furnish the same facilities to a farmer wishing to send one can of milk as to persons sending larger quantities; so that, at the present time, the producer is not at the mercy of the contractor to take whatsoever price may be offered, if he will only put himself in direct communication with the consumer, and take the responsibility of sending his own milk to market.

The economy of co-operation commends itself. One man, one horse, and one wagon, may take the milk of a dozen, or perhaps of a less number of producers, to the railroad depot, or deliver it, when possible, directly at the doors of consumers. The outlay of capital is thus borne by all interested in the undertaking, and not by one individual.

"If farmers understood the business details of their industry, if they had sufficient business discipline to confer with each other, and carefully determine, on commercial principles, what they ought to charge for their products, — having formed such co-operative associations as could execute their united will — they could then fix the prices of all their commodities, and hold them as steadily as they are now held after they get into the hands of commercial dealers. But the difficulty is, that farmers associate so little with each other, have never entered into any rational co-operation, but rather considered each other as competitors to be out-manœuvred in trade. . . . If they understood the situation, they would see that the real interests of farmers are mutual and reciprocal; that there can be no natural antagonism between them.

"Until they are educated in common business principles, and can see the identity and mutuality of their interests, and form associations to direct in the disposal of their great staple crops, their interests will be traded upon, without consulting them, by the whole middlemen class.

"We do not condemn the middlemen. They merely act for themselves, — buy the best they can, and sell the same. They form commercial alliances and boards of trade, and strengthen themselves in the most

sensible way, although there is not the necessity for it as with farmers. But farmers passively submit to their decision, submit to the inevitable. And this must continue, there is no help for it, till farmers shall think and act for themselves; and this requires so radical a change in this great body of society, that its accomplishment must be of slow growth.

"It is because these milk-dairymen, who, producing the milk, may regulate its sale on the principle of supply and demand, do not form associations for that purpose, that these 'few milk-dealers' are kind enough to fix the price for them. They merely perform a duty that the milk-dairymen omit. This is just like the self-sacrificing spirit of the middlemen everywhere. They are always spending their time in fixing the prices for the farmers; and yet the farmers do not seem to appreciate it."

A very recent effort "for giving people good milk, and farmers a fair profit," reported in "The New-York World," seems worthy of notice, as showing the tendency towards co-operation.

At a meeting of the Bedford Farmers' Club, at the residence of Mr. John Jay, near Katonah, Westchester County, the following resolutions were adopted: —

1. That a committee of three be appointed to consider the feasibility of co-operation by the farmers of the vicinity, for the direct delivery, under their own direction, of milk and other farm-products, to the consumers in New York, and, as regards milk, to fix the price paid by the consumer, and that received by the farmer. And the committee be requested to report their opinion on the tendency of such direct delivery to economize expense, to harmonize the interests of the producer and consumer, to enlarge the share of profit coming to the farmer and the certainty of its returns, and, as regards the consumer, on its tendency to afford additional security against adulteration, short measure, and misrepresentation of any kind touching the character and value of the article.

2. That the said committee, if persuaded of the feasibility of such an arrangement, be requested to report fully their views, and to submit a plan for putting the scheme into operation, with provision for securing in all cases a proper standard of excellence for maintaining alike the reputation of the farmers and the confidence of the public.

In offering the resolutions, Mr. Jay said that co-operation had received great attention in Germany and England, and has been considered in this country by all business men excepting farmers. Other business men have tried to protect their rights, and enlarge their interests; while the farmers, who are the chief national strength, have staid in a

condition of feeble independence, without protecting themselves against railroads and partial legislation.

The report of the above-mentioned committee will be anxiously awaited by all interested in the milk business.

Is it necessary for the farmers of Essex County to delay any longer in taking steps for the accomplishment of that which must evidently be for their mutual benefit? We think not.

Two profits can no longer be derived from the milk business: therefore the middlemen should give place to the farmer, who should demand and take the whole profit; for he deserves and needs it.

The time for action has arrived, when all good-intending milk-producers, especially in the neighborhood of large towns or cities, should organize and "pull together," either for co-operative milk-selling, or to fix a scale of prices, and provide means to prosecute the adulterators of that health-giving lacteal fluid so bountifully yielded by "Queen Cow."

J. D. W. French, *Chairman.*

THE BUTTER DAIRY.

HAMPSHIRE, FRANKLIN, AND HAMPDEN.

[From the Report of the Committee.]

The past year has been one of discouragement to butter-makers. The prices of dairy-products have been lower than for thirty years before, often netting less than a cent and a half a quart for the milk produced; so that very few cows have paid for their keeping. Still those whose butter has held a first-class reputation have been able to keep up their price to twenty-five or thirty cents a pound. This autumn the prospect is better. A good article of butter or cheese brings a fair price. But it is plain enough that the only safety for dairy-farmers in this section lies in closer management. To get any profit from making butter, it is necessary, first to increase the quantity from the same number of cows, and, second, to raise the quality, so as to command the highest market-price.

Between the cow and the butter-maker there is a point which cannot be too carefully guarded, — the way in which the milk is drawn from the cow, and handled before it reaches the milk-room. A very large part of the poor butter made results from the milk being spoiled before it is even strained. One lot of butter examined at the fair by your committee showed this at once: it was not fit for any use as food. Some, on tasting it, would have said, "Animal odor." Perhaps so, but not from the cow. If the cow is healthy, and has good food and pure water, there can be no odor or taste to the milk *in the udder* at all objectionable; nor will there be, if the milk is then drawn from a well-cleaned udder by a clean milker, in pure air, and kept away from all sources of taint. Others would have said this butter was "cowy." Don't lay such a charge to the poor

cow: she did her part faithfully. The butter that we complain of is not cowy: it is horsey, or piggy, or, worse yet, filthy. The cow keeper and milker are the persons to blame.

Let every butter-maker who has any regard for the reputation of his or her product insist upon every possible precaution being taken by the milker to keep the milk pure and clean. No really good butter can be expected if the milk is taken from an unclean bag, or by a milker with dirty hands or clothing, or if the milking is done in a filthy or ill-ventilated stable, or the milk allowed to stand, even a short time, surrounded by impure air. It is the greatest mistake to suppose, that, if dirt or foreign matter gets into the milk, careful straining will remedy the evil: the object may be removed; but the taint remains. It must also be remembered that there are invisible things as sure to spoil milk as those we can see. There are now improved implements which greatly protect the milk, guarding against carelessness and accidents; but nothing will take the place of careful, cleanly milking.

After the milk comes into the butter-maker's control, the first care should be to protect it from impurities, and odors foreign to itself. New milk is a most delicate, sensitive substance: nothing upon the farm (unless it be freshly-made butter) compares with it in absorbent power. It readily takes up any flavor or smell coming in contact with it. Families have been known to complain of their butter tasting of cabbage, when the farmer knew none had been eaten by his cows. But, on inquiry at home, it was found that a dish of hot boiled cabbage had been set on the pantry-shelf one cold day, when the room was tightly closed. Although the milk of but one day was in the room, and that several feet distant, the steam from this cooling substance had given its flavor to the milk so unmistakably as to injure the whole churning of which it was a part. Other things will have the same effect to a greater or less degree.

It makes very little difference whether the milk is set in pans or pails, deep or shallow; but let it be surrounded by pure air or water, free from every germ of pollution, — air *or* water, whichever circumstances make the most convenient for keeping the milk at a sufficiently low and unchanging temperature. Anywhere from forty degrees to sixty degrees

will answer, provided there be uniformity, and freedom from sudden changes after the milk has cooled down to the point at which it is to be kept. The chief advantages of the several patent "creamers" are the control they give over the temperature of the milk, maintaining *evenness* by air or water, and the protection they afford to the milk, keeping it from contact with the air of the apartment in general. They obviate thus the necessity of a special milk-room or dairy; but in such a room, well constructed, where the air is always pure, never damp nor too dry, and remaining at an even temperature, these modern appliances are quite superfluous. There can be no doubt of the economy, in time and labor, of deep setting in vessels of considerable size, perhaps a whole milking in one mass, rather than dividing into many small pans; and such methods certainly cause no loss in quantity and quality of the butter, many claim a gain. The benefit of low temperature is in a quicker separation of the cream; and while, in most cases, it is hardly worth the extra cost of ice and apparatus to get each milking skimmed before the next is set, milk ought to be so treated that all the cream will be formed within twenty-four hours.

The cream should be taken off while the milk is quite sweet. It has come to be a well settled fact that the finest quality of butter can only be produced from sweet cream taken from sweet milk. Many excellent butter-makers do not agree to this; but the weight of evidence is against them. And it is as unwise to keep the cream too long after it has been removed from the milk as to let it stand too long on the milk. Many persons advocate giving the cream time to "ripen," or "cure." This course probably adds slightly to the quantity of butter obtained; but it is at the loss of that delicate aromatic flavor which is so highly prized, and for which the extra prices are paid. It is well, if cream from several milkings is to be churned together, to stir it well after the last addition, and then let it stand long enough to have the same temperature, and an even consistency throughout the mass; but churn before there is any appearance of fermentation. Keep the creampot away from new, cooling milk, and where the temperature of its contents can be kept as closely as possible to sixty degrees. Variations in the temperature of cream make the churning harder, and injure

the quality of the butter. It is a mistake to "heal up" or "cool down" the cream just before putting it into the churn, or while churning. And, in churning, don't be in a hurry: it is very pleasant to have the butter "come" in three minutes; but makers of the very best butter prefer from twenty to forty minutes' churning.

As to the churn itself, no rule can be laid down. Very different churns are needed under different circumstances. Cream differs much, according to the cows, and the manner of treating the milk. There are more different creams than there are different churns. The butter-globules from some cows are much smaller and more numerous than in the milk of others: the smaller they are, the more beating the cream will bear without injury to the butter. So, too, very thick cream, as that from shallow-set milk, where evaporation has made it wrinkled and leathery, needs more violent action by the churn than the bulky and thinner cream obtained by deep setting in water. There is always danger, however, of over-churning. What is really wanted is *agitation* of the cream, rather than beating it; and therefore churns without dashers, empty boxes of different shapes, which merely *shake* their contents, closely approach this ideal of churning, and are coming more and more into favor. The nature of the cream should be considered in selecting the churn and in using it. Recollect that the only object is to rupture the little sacs which contain the fatty matter, so that its particles may collect, forming butter, and that it is very desirable to accomplish this without beating or pressing the butter thus formed.

More butter is spoiled by working it too much, or in the wrong way, than by all other causes, unless it be in tainting the milk before it is set. Butter does not require "working," as bread does kneading, to make it good. It is well to keep in mind just what is wanted through the whole process of butter-making: so we may briefly review.

In reality, we don't *make* butter, we only *get it*. Milk is an animal secretion, nearly nine-tenths water, which holds, in a solution of caseine (cheese) and milk-sugar, globules of certain animal fats. These fats in a natural combination we call butter. The fatty globules are enclosed in membranous sacs of caseine, or some similar albuminous substance.

The fluids and fats in it are of a most sensitive nature. Our first care should be to prevent any contamination or chemical change by reason of unsuitable temperature, or exposure to impurities. In short, the butter-globules are to be kept clean, pure, in their natural state, and separated from the surrounding fluid as soon as possible. For this purpose, we set the milk: under favorable conditions most of the globules rise to the top, and we remove what we call cream.

Cream is simply rich milk, — that part of the milk which contains the most fat and the least caseine and water; but good cream is usually more than half water. More or less of the fatty particles always remain in the skimmed milk. The next step is to keep the butter from changing while in the cream. The danger lies in the milk-sugar and caseine, still mixed with the butter-globules, and which soon undergo a change by fermentation: they "work," like common yeast, and act upon the fatty cells. Hence the cream should not be kept long, and while kept should be frequently stirred. The reason for stirring is, that air may be admitted to the cream, and mixed with it, and that retards the fermentation. The next is to still further separate the fats, or butter, by churning: this breaks the cells, or sacs, and the particles of pure butter collect, or adhere to one another. Gather the butter as we may, however, more or less water, and some of the broken caseine shells, will remain in it. The only object of "working" is to get these out. But the butter itself may have its "grain," or consistency, much injured by this mechanical action. The tendency of kneading, rolling, or pressing, is to disturb the peculiar combination of the fats, and make the mass soft and oily. This soft, oily, *shiny* look is often seen in butter, and indicates over-working. The best butter never shines: it has a dead golden hue, and dry, solid, waxy appearance. Such working may open the little cavities, and let water escape; but it will carry off very little of the caseine, and it is more important to get rid of that than of the water. Whatever of the caseine is so removed is done by the water, not by the manipulation, except as that moves the water.

Really, therefore, what is wanted is more water, and less working: in short, *wash* the butter — wash it repeatedly and thoroughly — with pure cold water: it is the surest way

of getting out the buttermilk, the caseine, and milk-sugar. Water poured over a large mass of butter does little good: it must reach as many of the little particles as possible, washing off any traces of the caseine sacs that yet remain. It is far better, therefore, to do the washing while the butter is in little particles or pellets than after it has been collected in a large mass: hence the philosophy, or, in other words, the *good sense*, of the granular method of butter-making.

This method, which does away altogether with the usual working, begins in its application at that point in churning where the cream first "breaks," and the butter begins to collect, or "come." The directions are as follows: stop churning as soon as the butter is seen in little pellets; move gently until these pellets are about the size of half wheat-grains, and then pour pure water into the churn, twice as much as there is buttermilk (it should be cold spring or well water, or reduced to fifty degrees, or thereabouts, in temperature): this causes the butter-granules to contract and harden. They may then be well washed by stirring the mass with the dasher, or by slowly moving the churn. Next take out the dasher, if there be one, and draw off the buttermilk and water: hold a little strainer or colander to catch any grains of butter that may escape. Again pour into the churn water enough to float all the butter, and wash and draw off, as before. Repeat this until the water flows off the butter quite clear. A last lot of water is added, and the butter-grains floating may then be dipped out with a small wire strainer, cup-shaped, with handle, and placed in a bowl, — dry, hard, golden grains, ready to salt. (If the churn be one in which it is inconvenient to wash the butter, and change the water, the butter may be dipped out a few moments after putting in the first water, — just as soon as the grains are chilled, — and then washed in any handy vessel.) Treated thus, the butter will be freer from buttermilk than after any known method of working, and in much better condition for salting. This would seem to be enough: it is hard to believe that any caseine remains in it; but there is some yet, and the process may still be improved upon. Made as described, the butter will contain from ten to fifteen per cent of water, and, if any fragments of caseine are left in it, these, moistened by the water, and exposed to the

air, especially if the weather is warm, become rapidly changed into a ferment, and the delicate qualities of the butter are at once destroyed.

It may be impossible to discover caseine, even with a powerful microscope; but just try this experiment: place the granular butter, after being thoroughly washed, into cold, well-strained brine made from the best salt, and pretty strong (enough brine to float all the butter); let it thus stand for an hour or two, occasionally stirring it gently; then drain off the brine, boil it down slowly, and there will rise to its top a scum tasting and smelling decidedly like cheese. This is caseine, in small quantity, removed from the butter-grains by the brining process. This additional precaution of brining is therefore recommended. *Any thing* that will add to the quality of the butter and to its keeping properties is worth doing. When, in washing, the last water used has passed off clear, pour on the cold brine, and treat it as described. Perfectly fresh butter in the granular form may be kept for weeks in brine, in air-tight cans, like fruits, and salted when taken out for use. In some places now, butter is sent to market in this form, and sold at fancy prices. After the brining, remove the butter to a bowl, drain it well, and sprinkle over it the right quantity of salt. Let it thus stand some hours; then, with wooden paddles, carefully draw the butter-grains together, making it into such form as is desired, but with as little pressure and rubbing as possible.

The quantity of salt to be used is, of course, a matter of taste. There is, however, a very marked tendency in this country towards the use of fresher butter. Very little of the highest-priced butter receives as much as an ounce of salt to a pound of butter. In many first-class dairies six ounces to ten pounds is now the rule; and, for some fancy brands, only half as much is used. Whatever the quantity used, let the salt be of the purest and best: this matter of the quality of salt used in butter deserves more attention than it receives.

HENRY E. ALVORD, *Chairman.*

THE POULTRY-YARD.

BRISTOL.

[From the Report of the Committee.]

The Plymouth Rocks were numerously represented, this excellent breed evidently growing in favor with our farming friends. Few breeds combine so many valuable qualities. As winter-layers they have no superiors, if any equals; and, weighing from six to eight pounds, they are excellent poultry for the table. Like all races which have an Asiatic strain in them, it will not be found profitable to keep them after they are two years old, as, after that time, the Asiatic propensity to sit develops itself strongly. The young pullets begin to lay nearly two months earlier than the Brahmas or Asiatic varieties. This is emphatically one of the breeds which it will repay the farmer to breed pure. To the poultry-fancier who has been accustomed to other longer established breeds, it may not be quite so satisfactory as some other varieties, from the fact that great care must be taken in the selection of a cock to match the pullets in order to secure the best markings.

The standard of excellence needs revision; for, as it now reads, no pair of Plymouth Rocks properly mated for breeding can take a premium: in other words, it is necessary to show a bird highly ornamental perhaps, but of no possible use as a breeder, merely to fill the requirements of the show pen. It has been conclusively demonstrated that a cock and hen of the same color or tint of plumage will throw birds too dark, if both are of the standard shade, or *vice versa* if both are too light. Now, there would be just as much sense in requiring the cock and hen of the black red game variety to be nearly the same in color in order to take a premium in the show pen, as insisting on the requirement as it now

stands in the case of Plymouth Rocks. The writer this year, against his judgment, adopted the advice of a noted breeder, who has a theory, that, if one breeds the same colored birds, their chickens, or at least many of them, will come out all right, though there may be a few black birds. The result proved that he was wrong; for, of all the pullets hatched from that mating, every one was too dark. The average farmer, however, whose main object is to secure a plentiful supply of eggs and poultry, need not trouble himself greatly about these minor points. If he will take the trouble to procure a light colored cock every two years, of another strain, he will have little difficulty in rearing some birds which will command extra prices; but in any event he will have a hardy, prolific race of birds, that will fill all his requirements in the way of egg production and poultry.

The experiments of different crosses are interesting, and it may be well to suggest a few which have been proved to be valuable. The Houdan crossed with the black Cochin or dark Brahma makes a large, handsome bird, generally coal black. The laying qualities, for which the Houdan is noted, are retained, and greater size is the result. The white Cochin and white Leghorn make another valuable and handsome cross. The silver gray Dorking crossed with the dark Brahma makes a very handsome bird. The Game fowl will improve the plumage, and enhance the beauty, of nearly all the larger breeds, and will add hardihood to any strain which has suffered from too close or in-and-in breeding. The Partridge Cochin crossed with the brown Leghorn makes a valuable and handsome bird, retaining the prolific qualities of the latter, and gaining largely in weight.

THE BEST BREED TO KEEP.

There is no question more common or more perplexing.

In the selection of a breed, the situation, the range, the character of the soil, must be first considered, and, second, the object which the purchaser has in view, — whether the production of eggs or poultry. If there is plenty of range, and eggs are the main object, the Leghorns, Houdans, Game, and Hamburg varieties will be found among the most profitable. For winter-layers the Plymouth Rocks have few equals, and no superiors. If the latter are confined, and fed

exclusively on corn, they are apt to become so fat as to seriously interfere with their laying qualities. They should therefore have a good range of at least an acre of grass to every twenty-five. If the range is limited, Brahmas, Cochins, and their crosses, will be most profitable. If the soil is heavy, and inclining to be damp, the Dorking, Black Spanish, and Poland varieties will be found especially unprofitable, these breeds having a tendency to roop.

THE BEST FEED.

In summer time, buckwheat, wheat, oats and plenty of grass, cabbage, or other vegetable diet, should be fed instead of corn exclusively: in winter, corn is the best grain, as it generates more heat. There must be more or less meat in some form given to fowls in winter, particularly when there is snow on the ground. Remember that snow practically destroys the range. Poultry are at such a time like a garrison closely besieged, and require extra attention to keep them in health. Let the water always be renewed daily. In ordinary winter weather a pail of hot water twice a day will satisfy their needs.

CLEANLINESS.

This is of the very first importance. Lice being the foundation of nearly all the diseases of poultry, the use of whitewash mixed with sulphur and salt every spring and fall, and kerosene-oil or carbolic acid applied to the roosts, is very important. The house should be cleared of all manure as often as once a week, or oftener if possible, especially in warm weather.

A little carbolic acid is a valuable ingredient in the whitewash, and carbolic eggs put into the nest of a sitting hen a few days after she has begun is an excellent precaution.

In this connection it may be well to urge the use of movable boxes for nests, as these can be taken out, and easily scalded with hot water, after the hen has hatched.

It is well to take the hen off the nest, and powder her well with flour of sulphur, two or three days before hatching.

E. RODMAN, *Chairman.*

APPENDIX.

THE MASSACHUSETTS AGRICULTURAL COLLEGE.

SOME FACTS IN REGARD TO ITS HISTORY, ITS OBJECTS AND PURPOSES, AND THE CHARACTER AND EFFICIENCY OF ITS WORK.

[FROM THE REPORT OF THE TRUSTEES.]

THE College is now, for the first time in several years, practically free from debt. Since the adjournment of the last Legislature, it has been thoroughly re-organized, so as to place it, if possible, upon a sound and strong financial or business basis. The current expenses have been reduced by more than ten thousand dollars a year, — sufficient to bring them within the income of the institution, and to leave a small margin.

To effect this reduction, it has been necessary to abolish one professorship and to withhold the president's salary. The salaries of one or two professors, and that of the treasurer, though small already, were somewhat cut down; while a saving of about four hundred dollars has been made in the janitor's work, and a little more than that in the office of farm superintendent. It is impossible to see how the expenses can be reduced to a much lower figure, without seriously crippling the usefulness of the College, and curtailing its efficiency.

The real estate of the College, or what, to use a business phrase, may be called "the plant," — including the land of the farm, the dormitories, halls, boarding-houses, and other college and farm buildings, — have cost two hundred thousand dollars. The college fund now in the hands of the State treasurer, and to be kept there in accordance with the provisions of the Act of Congress accepted and agreed to by the formal action of the Legislature, amounts to $360,067.40. Two-thirds of the income of this fund is by law paid over to the treasurer of the College, and one-third to the treasurer

of the Massachusetts Institute of Technology. When it is reported, therefore, that the State has at different times appropriated $255,000 for the establishment and maintenance of the College, it ought, in justice, to be borne in mind that the greater part of this large aggregate (nearly three-fifths) was given in the form of an addition to the fund arising from the sale of national land scrip, not a dollar of which has been expended, and that the College receives but two-thirds of the income of this fund; so that the advantage of these generous gifts does not wholly accrue to the Agricultural College, and its income is, in consequence, very much less than it otherwise would be.

The financial embarrassments of the College have arisen, in part, from the reduction of the income of the fund in the hands of the State treasurer, consequent upon the general depression of business so universally prevalent during the last few years, and in part, it must be admitted, from want of attention to business details in the expenditures of the farm and other departments of the institution. The re-organization was designed to remedy these defects, and it is believed that it has accomplished the object. The financial status of the College may be presented substantially as follows: —

Real estate	$200,000 00
Farm stock appraised at	2,747 00
Implements, vehicles, &c.	1,005 50
Farm produce on hand	2,019 25
	$205,771 75

RESOURCES.

Income of fund in State treasury	$12,000 00
Income from other funds	700 00
Income from tuition, room-rent, &c.	3,500 00
Total income	$16,200 00

EXPENDITURES.

Salary account	$10,100 00
Current expense account	4,000 00
Extra instruction	800 00
Cost	$14,900 00

In the above estimate of expenditures no allowance is made for a president's salary. It is impracticable to reduce

the teaching force of the College below its present limits. One professorship, as already stated, has been vacated by the action of the trustees during the past year, for the ex press purpose of keeping the expenses within the income; but it must be evident that this reduction cannot be carried further without great injury to the reputation of the institution. The studies to be pursued must be such in variety, in extent, and in value, as shall meet in good faith the requirements of the Act of Congress to which we are indebted for the original endowment. It must be presumed that in accepting the grant, and obligating itself to fulfil its conditions, the State meant to do it honorably, and to comply with the spirit as well as with the letter of the Act.

No one can fail to see, in reading the conditions of the grant, that it implies something more than the maintenance of a mere manual labor school. The very name of "College" implies a broader and more generous culture: it implies a place of education for the young. Whatever the institution may do in the way of affording models of farming for the public, or in searching for new facts, or the investigation of scientific principles applied to agriculture, must be secondary, and subordinate to the main objects, which the very name given in the Act of Congress implies. The leading and prominent idea conveyed is that learning and labor, science and practice, are to meet in a more profitable life upon the farm; that the chief aim shall be to develop the man in the farmer, and to develop farming through the man engaged in it. This means discipline, which lies at the foundation of all genuine education: it means that we are to do something to educate the mind as well as the hand, to make intelligent men and good citizens, and this object has been kept constantly in view.

It is to be borne in mind, that, at the time the College was founded, there were no models in this country by which our early steps could be guided. Many institutions of the kind had been established and maintained by most of the governments of Europe, and some of them were broader in scope than our own; but they could hardly furnish any complete guide for us in circumstances so widely different. Mistakes might, therefore, have reasonably been expected. But whatever mistakes may have been made by the trustees, acting

as the agents of the Commonwealth, the history and the record of the College have, on the whole, been honorable, and highly creditable to the State. It was opened for the admission of students in 1867; and since that time more than six hundred and fifty have been admitted on examination or diploma. The yearly average number of students has exceeded a hundred. Its first class graduated in 1871; and it has graduated a hundred and fifty-seven in all, more than a third of whom are devoting themselves exclusively to agriculture, and pursuits intimately connected with it. In addition, it has given instruction to four hundred others who have taken partial courses in agriculture, and returned to the farms from which they came.

The facilities gathered there for illustration, and for imparting a sound and substantial education, in which the natural sciences constitute the basis, are much greater than has been commonly supposed. The College library consists of over two thousand volumes, mostly on technical subjects, embracing every department of agriculture and the natural sciences. The Knowlton Herbarium contains more than ten thousand species of catalogued plants and botanical specimens. The State cabinet of geology, ornithology, and entomology, is complete in its illustration of the natural history of Massachusetts. The chemical laboratory has accommodations for seventy students. This department is in a high state of efficiency. Practical laboratory work is required of each student daily for an entire year.

The department of physics and civil engineering, under the charge of Professor Graves, is well equipped with apparatus; and practical field-work in surveying, laying out roads, &c., is required of every student, sufficient to give him a knowledge of the most approved instruments, and methods to be pursued under a great variety of circumstances. The military department, required, officered, and equipped by the General Government, and under the charge of an accomplished army officer, a graduate of West Point, affords unsurpassed facilities for valuable discipline, and is educating far more thoroughly and completely than any militia system can be expected to do, a large number of young men, who go out capable of serving as officers or soldiers in case of emergency. This feature of the course of study and train-

ing, as was said in the last Report, is far more important than is generally supposed, and has from the first received the most careful attention, and been eminently successful. The horticultural department, under the charge of Professor Maynard, contains extensive plant and propagating houses, peach, pear, and apple orchards, vineyards and nurseries, affording ample facilities for instruction and for the labor of students, who are paid by the hour for all work beyond the limits of what is called "class-work," which is required of all students six hours a week as a part of the educational course.

The farm, of nearly four hundred acres, must be regarded as an important adjunct of the College, as it affords facilities for observation and labor which could not be had without it. It has been somewhat cramped for means, and has been required to do a vast amount of work — in the way of grading grounds, building roads and walks, and teaming of various kinds — for the College, so that its accounts have not shown its actual working; but its capacities for usefulness in connection with other departments of the College are too obvious to need comment.

Though the education and training of young men must be regarded as the primary object, the contributions of the College to the science and practice of agriculture have been extensive and valuable; and they are universally recognized throughout the country as in the highest degree creditable to the institution and to the State: they have, indeed, in repeated instances, been taken as the basis of important legislative action in other States. The following may be stated as a few of the subjects that have been investigated, most of them exhaustively, and with valuable practical results: —

1. The growing of sugar-beets, the manufacture of sugar from them, and trials of their value for cattle foods. This industry is soon to grow up in our midst, and to absorb large amounts of capital.

2. The sources of supply and the quantity and quality of our manurial agents. These careful scientific investigations have been the prime means of revolutionizing the manufacture and trade in fertilizers, not only in this State, but throughout the country.

3. Laboratory and physical examinations of the South

Carolina phosphates, and trials of their agricultural value in the raw state, and after treatment with acids.

4. On the use and effect of common salt on the grain and root crops.

5. The chemical and physical condition of the salt-marshes of the State, and the devising of methods by which they can be made available for agricultural purposes.

6. Experiments with compound commercial fertilizers to test their comparative agricultural value, and their value as compared with single elements.

7. To determine what elements will make practically a complete manure on our average soils.

8. Investigations of the quality and composition of commercial fertilizers offered for sale, and the protection of the community, by legal control and inspection, from frauds in them.

9. Observations and study of the phenomena of plant-life.

10. The circulation of sap in plants, and their expansive power during growth.

11. To determine the proportions of different elements of nutrition in feeding substances to be used, to save needless expense, and to produce the most certain results.

12. Experiments on the continuous growth of crops on the same soil, with chemical fertilizers alone.

13. The influence of different kinds of fodder-plants fed to milch cows on the quantity and quality of their milk and butter.

14. Examinations and trials to test the comparative value of different methods of setting and treating milk in the butter-dairy.

15. Practical trials of new implements and a great variety of farm machinery.

16. Investigations as to the effect of girdling fruit-trees and plants to hasten the time of ripening, and to improve the quality of the fruit.

17. The effect of chemical salts on the carbo-hydrate contents of plants and the quality of fruits.

18. The construction and repair of common roads.

19. The growing of early-amber cane, and the manufacture of sugar from its juice.

20. The influence of temperature, and the vital functions

of plants, and temperature of soils and air, on the changes in form of water in soils, and plants and vapor in air.

21. Investigations in relation to the evaporation and percolation of water from the soil.

22. The tilling of soils of different characteristics as affecting the loss of water by evaporation.

23. The determination of the elements of plant-nutrition lost from the soil by leaching and of those it retains.

24. Investigations in relation to the comparative temperature of the soil and air by day and by night.

25. The establishment of true meridian lines to regulate the practice of surveying.

26. The comparative study of the milk of different breeds of cows.

27. Accurate investigations of the comparative nutritive and feeding value of Northern, Southern, and Western varieties of Indian corn.

This list, which might be greatly extended, will serve to show the wide range of scientific study and investigation to which the attention of the College has been devoted. "From this day forward," said Professor Agassiz, when a single one of the above papers was presented to the State Board of Agriculture in 1873, — "from this day forward, the Agricultural College at Amherst has its place among scientific institutions, if it had not before; for only those institutions have a place in the scientific world which do something, and this is something extraordinary: it is a revelation to physiologists. Let me say to those who have not thought that the Agricultural College was doing any thing worth its expense, that the production of this one paper has amply paid for every dollar which the State has thus far bestowed upon the institution."

Equally unqualified testimony might be presented with reference to the high character and value of nearly every one of the investigations named in the above list. Every land-surveyor, for instance, knows that previous to the establishment of permanent monuments in every county of the State, giving the accurate meridian lines, the means of correcting his instruments were comparatively difficult of access; and when it is considered that very many of our farms are bounded and described by the points of the compass, often for long distances, it is easy to see that the College has had its influence

upon nearly every farm in the State, and that, too, in more ways than one. It can justly challenge comparison with the work of any other similar institution in the country, both in its contributions to science and to the methods and results of intelligent practice.

But these investigations, as already intimated, are secondary, and subordinate to the chief object of the institution, — the education of young men for the practical pursuits of life. That the College has fulfilled its mission in this direction is sufficiently evident from the reports of the Examining Committee of the State Board of Agriculture. In its capacity as a Board of Overseers of the College, it has, for several years, appointed a committee to examine into the condition and working of the institution, and especially to examine the graduating classes from year to year, and to report upon their proficiency. These reports have appeared in the reports of the Secretary of the State Board of Agriculture, where they are accessible to the public.

It will not be out of place, for obvious reasons, to present, as briefly as possible, the opinions of experts who not only had abundant opportunity, but whose special duty it was, to investigate all departments of the College, and pass judgment upon them. The Examining Committee of the past year, Dr. James R. Nichols of Haverhill, editor of "The Journal of Chemistry," chairman, submitted a report, from which the following is an extract: "The duty assigned to me the present year, of visiting the Agricultural College at Amherst, and conducting the examination of the senior class, was pleasant, and also encouraging as regards the usefulness of the institution. The College has labored under some peculiar difficulties and discouragements in the present and past years, owing to the want of means to carry forward the work of the institution as planned by its officers. The graduating class was found to be small, numbering only seven; but their appearance and acquirements were certainly very creditable.

"The examination was conducted with the view of obtaining as clear an insight into the results of the practical workings of the College as possible; and every facility was afforded by Professor Stockbridge and others that could be desired. For a period of nearly or quite three hours the young men

of the class were under examination; and the questions put to them were such as must of necessity call out answers to be made promptly, without the aid of books or instructors. and the results were highly gratifying. A prominent aim was to ascertain if the young men were really qualified to go upon a farm, and conduct its operations in an intelligent and practical manner. It was deemed desirable to learn if they had been instructed in a way to enable them to carry forward the principles of advanced husbandry so as to promote its best interests wherever they might be located. This requires a knowledge of the principles and practice of chemistry, also an acquaintance with the physical character of soils, their origin, and methods of reclamation and fertilization; the nature and nutritive value of the cereal grains, roots, and grasses; the value of the different breeds of animals, and the best methods of feeding and utilizing their products; the care of seeds; and all the implements of husbandry. Upon these points and many others the young men were examined sufficiently in detail to bring out what they really knew; and it is gratifying to report that the answers showed marked proficiency in these departments of study. They were such as to increase our confidence in the usefulness of the College in its direct bearings upon the agriculture of our state and country."

An equally authoritative indorsement might be presented from every committee whose duty it has been to examine into and report upon the details of the working and efficiency of the College. The Committee of 1870, for instance, Professor Louis Agassiz, chairman, say, "The examinations of the students in classes have been upon agriculture, horticulture, botany, physiology, chemistry, geology, mental and kindred sciences; and we have witnessed the military drills, and observed with gratification the topographical drawings by the students. We are convinced that the system of instruction is well calculated for the ends in view, that the students are making commendable progress in their studies, and that the several professors are not only accomplished in their respective departments, but earnest and thorough in the prosecution of their duties.

"The leading object in this institution, in compliance with the Act of Congress to which it owes its endowment,

is to teach such branches of learning as are related to agriculture, and to include military tactics; and it seems to us that the course of instruction laid down is eminently in consonance with that object, and that the sciences taught are with pointed reference to the uses of the farm. The theory of scientific agriculture is thoroughly taught, and the application of such knowledge is made on the farm, under the direction of the professor of agriculture, who is a practical farmer; and all students are compelled to work at the details of husbandry; so that manual labor becomes a valuable adjunct to mental application. Chemistry, botany, physiology, and zoölogy, are, of course, invaluable to the farmer in regard to the analysis of soils, the use of manures, the food of animals, the growth of grains and fruits, the anatomy and physiology of animals, and the conditions and habits of destructive insects; and mathematics and civil engineering, in the case of the chain, compass, and level, are almost equally necessary.

"Your Committee cannot refrain from alluding to the interest which all the young men take in the drills, and the evident beneficial effect upon their bearing and health, and the value of the accomplished soldiers and officers thus made for the future service of the Commonwealth in the event of another call to send forth her sons for herself or the nation. Were no other result accomplished by this institution, the money of the Commonwealth could be no more judiciously expended; and yet this instruction is but an incident to the regular course."

The Examining Committee of 1871, of which Professor Agassiz was still the chairman, after visiting the College several times, and a careful inspection of all its details, state in their report that "the graduating class, consisting of twenty-seven members, acquitted themselves with great credit in their several examinations, and graduating exercises. Their uniformly gentlemanly bearing and manly appearance were noticeable in a marked degree. No one could look upon that company of young men without realizing the wisdom and foresight of those minds that originated the idea of requiring 'military tactics' to be taught in agricultural colleges. The influence of their military training was so manifest, not only upon their general physical health and

development, but also in those indispensable attributes which help to make a true gentleman, that we do not believe too much importance can be laid upon this branch of their education, both as exerting a healthful influence upon the students themselves and as a safeguard for the protection of our country in the future."

The Examining Committee of 1872, Hon. Leverett Saltonstall, chairman, having attended the quarterly examinations, and the annual graduation exercises in the month of June, say in their report, "It is truly wonderful, that, in so short a time, this admirable institution should have assumed such proportions. Only incorporated in 1863, receiving its first class late in 1867, it now stands in the front rank of agricultural colleges in this country, — an object of reasonable pride to the Commonwealth.

"The classes in April were examined in botany, moral philosophy, agricultural chemistry, mathematics, English literature, and practical farming; at Commencement (*inter alia*), in the relation of science to practice in agriculture, renovation of exhausted soils, rotation of crops, manures, stock-husbandry, and in agriculture as a business-pursuit; in November, in road and railroad construction, zoölogy, use of manures, chemistry, and military drill; all of which were creditable alike to professors and students, the relations between whom seem to be of the most agreeable nature."

The Committee of 1873, Dr. Horace P. Wakefield, chairman, enter into the condition of the institution at considerable length, both as to the details of the farm and the educational departments, and say, "In November, at the close of the term, the freshmen were examined in physiology, the sophomores in agriculture, the juniors in physics, and the seniors in botany. The classes acquitted themselves creditably; and, when compared with similar performances a little to the south forty years ago, they were of a high order. But facilities, advantages, and times change; and boys must change with them. Not that every student was a perfect master of the subject he had studied, an adept in science, — the teachers themselves would not claim that, — but these young men were familiar with the principles laid down in text-books, and inculcated by their teachers, and showed that they had them fixed in their minds, and could use them in stating a proposi-

tion, and defending the same, even when questioned by the professors. Having gathered a few facts, they had made them their own, and had the manliness to stand by their theories, and defend their positions. Evidently they had been taught to think, and that is education in its essence.

"The conservatory is an honor to the institution and the State. From the laboratory, with its appliances for teaching agricultural chemistry, and its liberal, learned, and live professor, so competent to fill such a position anywhere in the world, results may be looked for of the highest order, and expectation without limit must be realized."

The Committee of 1874, Joseph N. Sturtevant, Esq., chairman, visited the College several times, carefully examined into the workings of all its departments, and say in their report that "the occasion of the examination of the graduating class, to mark who should be the recipients of the Grinnell Agricultural Prizes, was of much interest. The young men, as they replied to the questions addressed to them, in language lucid, unconventional, and thoughtful, showed that they carried with them from the College something of real value. We think of no occasion when the College appeared to so good advantage.

"The presence at the College of a United-States army officer as professor of military science and tactics secures able instruction in this essential part of the education of the complete citizen. If we pass by the chance of war, and the value of possessing among the people individuals fitted by previous training to become militia officers upon sudden call, the value of a military training as promotive of a manly bearing, orderliness, promptness of action, and fitness of speech, &c., is obvious, and recurs with greater force to such as witness the several classes in their military manœuvres. We trust there will be no diminution of interest in the military features of the College."

The Committee of 1875, Hon. Edmund H. Bennett, chairman, made two official visits to the College. Judge Bennett says in his report, that the committee "were deeply impressed with the value and importance of a scientific agricultural school and an experimental farm such as we there possess, and of the general success with which the same has been managed. They desire also to express their high apprecia-

tion of the scientific experiments made there, and its importance as a permanent scientific station.

"The 'leading object' of the College is, as its charter declares, 'to teach such branches of learning as are related tc agriculture and the mechanic arts, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life.' From this it seems that the primary purpose was to give to farmers' sons and others of the industrial class such useful and practical training as would best fit them for their contemplated pursuits in life. Other branches of scientific and even classical study might also be pursued; but apparently they were, in the mind of the Legislature, but auxiliary to the main purpose of this particular school. Without saying whether one course of study is more or less important as a general rule in society, this institution was not founded as a classical, a medical, or a theological school, but simply as an agricultural college. With its splendid endowment, its large and noble farm, its healthful and admirable situation, its convenient and ample buildings, its admirable and salutary military discipline, its corps of accomplished, scientific, and enthusiastic instructors, it ought to occupy a high position in the agricultural world; it ought to be 'a burning and a shining light,' attracting the attention, and becoming the pride and admiration, of every son of Massachusetts throughout the land."

The Committee of 1877, O. B. Hadwen, Esq., chairman, reported at considerable length upon the management of the farm, and say, "The productive capacity of the farm is rapidly increasing, the acres yielding larger annual returns. Unproductive lands are being renovated, and brought into profit; rough places being made smooth; the preliminary labors with view of improvement are nearly completed; and the whole outlook of the lands is more pleasing to the eye in all respects. As far as we are able to form an opinion from observation, we are satisfied that the Agricultural College will instruct and turn out men who can use both head and hands, — men pre-eminently fitted for the business relations of life; and that agriculture will be exalted and stimulated by men trained to close and exact observation in the varied departments of rural and farming pursuits."

The Examining Committee of 1878, Dr. James R. Nichols, editor of "The Journal of Chemistry," chairman, say,—

"We say unhesitatingly that the young men acquitted themselves exceedingly well; and no one of them appeared incompetent for taking charge of a farm, and conducting its affairs in accordance with good sense, and advanced knowledge of husbandry. They had evidently been well drilled in the 'science of agriculture;' and the drill embraced the various departments which closely and remotely relate to the interests of the farm. Each of the young men was required to write upon a practical topic, without text-books, or any aid except what his own knowledge supplied; and thus above twenty essays were placed in the hands of the Committee for examination. This was an important test of scholarship, and supplied a clew to the general training or culture of the students of the College. Some of their papers were quite extended and able essays, worthy even of publication. We are pleased to be able to bear testimony to the good appearance of the graduating class at Amherst."

These extracts from the reports of impartial judges thoroughly competent to form an opinion of the work of the College, and having every opportunity to do so, will be a sufficient answer to the persistent, unjust, and undeserved misrepresentations of a portion of the public press.

One would suppose that the unanimous indorsement of every committee charged with the duty of examining into the condition of the College, and reporting upon its efficiency, would be conclusive to every intelligent mind that it ought to be sustained, and sustained nobly and liberally, to be a source of pride and honor to the state and to the country through whose instrumentality it was originally founded. If there were no other reason for this, to be found in its intrinsic merits, and the good it has done and is capable of doing, the simple fact that it is and must be regarded as the index, the outward and visible sign, to all men, of the way in which we keep our contracts, ought to be sufficient.

CHARLES L. FLINT, *President.*

Boston, Feb. 6, 1880.

COURSE OF STUDY AND TRAINING.

FRESHMAN YEAR.

First Term. — Chemistry, 3 hours each week; Human Anatomy, Physiology, and Hygiene, 3 hours; Algebra, 5 hours; English, 2 hours; Agriculture, 2 hours; Declamation, 1 hour; Military Drill, 4 hours; Manual Labor, 6 hours.

Second Term. — Inorganic Chemistry, 3 hours; Botany, 3 hours; Geometry, 5 hours; Agriculture, 3 hours; English, 2 hours; Elocution, 1 hour; Freehand Drawing, 3 hours; Military Drill, 3 hours.

Third Term. — Systematic Botany, 4 hours; Geometry, 4 hours; French, 5 hours; Elocution, 2 hours; Agriculture, 2 hours; Military Drill, 4 hours; Manual Labor, 6 hours.

SOPHOMORE YEAR.

First Term. — Systematic Botany, 3 hours each week; Geometry, 4 hours; French, 5 hours; English, 1 hour; Agriculture, 2 hours; Declamation, 1 hour; Military Drill, 4 hours; Manual Labor, 6 hours.

Second Term. — Geology, 3 hours; Trigonometry, 5 hours; French, 4 hours; English, 1 hour; Agriculture, 3 hours; Declamation, 1 hour; Drawing, 3 hours; Military Drill, 3 hours.

Third Term. — Zoölogy, 5 hours; Surveying, 5 hours; Agriculture, 2 hours; English, 3 hours; Declamation, 1 hour; Levelling, 3 hours; Military Drill, 4 hours; Manual Labor, 6 hours.

JUNIOR YEAR.

First Term. — Mechanics, 5 hours each week; Entomology, 2 hours; Market-Gardening, 2 hours; Horticulture, 2 hours; Military Drill, 3 hours; Manual Labor, 6 hours.

Second Term. — Physics, 5 hours; Practical Chemistry, 9 hours; Drawing, 3 hours; Agricultural Debate, 1 hour; Declamation, 1 hour; Military Drill, 3 hours.

Third Term. — Astronomy, 4 hours; Practical Chemistry, 9 hours; Declamation, 1 hour; Stock and Dairy Farming, 2 hours; Military Drill, 4 hours; Manual Labor, 6 hours.

SENIOR YEAR.

First Term. — English Literature, 4 hours each week; Practical Chemistry, 7 hours; Book-keeping, 2 hours; Roads and Railroads, 3 hours; Military Science, 2 hours; Original Declamation, 1 hour; Military Drill, 3 hours.

Second Term. — English Literature, 4 hours; Theses, 1 hour; Mental Science, 4 hours; Agriculture, 2 hours; Veterinary Science, 3 hours; Military Science, 2 hours; Microscopy, 4 hours; Military Drill, 3 hours.

Third Term. — Veterinary Science, 2 hours; Military Science, 2 hours; Botany, 3 hours; Landscape-Gardening, 3 hours; Rural Law, 1 hour; Lectures on English Language, 2 hours; Theses, 1 hour; Agricultural Review, 4 hours; Military Drill, 4 hours.

ADMISSION.

Candidates for admission to the Freshman Class are examined, orally and in writing, upon the following subjects: English Grammar, Geography, Arithmetic, Algebra through simple equations, and the History of the United States.

No one can be admitted to the College until he is fifteen years of age; and every student is required to furnish a certificate of good character from his late pastor or teacher, and to give security for the prompt payment of term-bills. Tuition and room-rent must be paid in advance at the beginning of each term; and bills for board, fuel, &c., at the end of every term.

The regular examinations for admission are held at the Botanic Museum, at nine o'clock A.M., Tuesday, June 22, and on Thursday, Aug. 26; but candidates may be examined and admitted at any other time in the year.

The first term begins Aug. 26, 1880.

EXPENSES.

Tuition	$12 00 per term.
Room-rent	5 00 to 10 00 "
Board	2 50 to 3 50 per week.
Expenses of chemical laboratory to students of practical chemistry	10 00 per term.
Public and private damages, including value of chemical apparatus destroyed or injured .	At cost.
Annual expenses, including books . .	$250 00 to 350 00

INDEX TO SECRETARY'S REPORT.

INDEX TO ABSTRACT.

New York Botanical Garden Library
3 5185 00259 1459